SCHOOL HYGIENE.

BULLETIN OF INFORMATION NO. 7

THE NATURE AND CAUSE OF COMMUNICABLE DISEASES

ALSO SUGGESTIONS RELATIVE TO

DEFECTIVE EYES AND EARS

SPINAL DISEASES

HEATING AND VENTILATION

ISSUED BY

L. D. HARVEY, State Superintendent

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INTRODUCTION.

This bulletin is issued by the State Superintendent and distributed to the school officers and teachers of Wisconsin with the view of calling their attention to a most important phase of educational work. Unless the health of the children attending the public schools can be safeguarded by proper sanitary precautions, it seems futile to attempt to give them intellectual training. Without a sound physical body in which to develop the mind, the full end and aim of educational instruction can not be accomplished.

In the school room where all sorts and conditions of children are congregated, there is a prolific field for the spread of disease by means of germs. It is therefore essential that the public school teachers be instructed in The Nature and Cause of Communicable Diseases, that they in turn may lead the pupils to realize the danger from contagion and the necessity of exercising every possible precaution to prevent it. We are indebted to Dr. H. L. Russell, professor of bacteriology in the state university, for the very practical and timely article on Communicable Diseases contained in this bulletin. Dr. Russell has given a practical exposition of the subject, with the view of presenting as clearly as possible the more important facts regarding disease germs.

The other subjects briefly treated in this bulletin are, Defective Eyes and Ears, Spinal Diseases; Heating and Ventilation. Suggestions are offered which, if followed by school officers and teachers, will do much to promote the interests of the school by giving attention to the subject of school room hygiene.

Very truly yours,

L. D. Harvey,

State Superintendent.

OUTLINES REGARDING THE NATURE AND CAUSE OF COMMUNICABLE DISEASES.

BY H. L. RUSSELL AND W. D. FROST, OF THE UNIVERSITY OF WISCONSIN.

For the Use of Public School Teachers.

INTRODUCTION.

H. L. RUSSELL.

While the germ theory of disease has been generally accepted by the medical world and the treatment of many diseases profoundly modified by the discoveries that have been made in this field of science, yet the public at large is sadly wanting in an accurate understanding of these matters; and not only during seasons of epidemic disease, but at other times, it suffers much from a lack of definite knowledge concerning the causes of these communicable diseases, their method of propagation, and the successful measures that have been devised to either ward off or overcome their effect on human beings. While such a knowledge should primarily be possessed by every medical man as a servant of the public, yet, it is absolutely necessary for the public welfare that the masses themselves should be taught the principles underlying these matters; for it is this class which is primarily affected, and upon which the loss falls.

The most feasible place to do this is manifestly in our public schools. True it is that this subject receives more or less consideration in university curricula, but its importance demands that the information to be imparted should be given to the masses, and not merely to the few. The objection may be urged that the courses of study in our public schools are already over-

crowded; therefore, there is no room for a subject that is more or less new; but the question of greater import is whether this subject is not of more real importance than some of the studies now pursued.

What knowledge is of most value to the individual? Manifestly that which enables him to maintain his own and his family's existence. Such knowledge unquestionably is of more foundational importance than that which fits one even for citizenship or society. Desirable as are those studies which prepare one to enjoy the leisure pursuits of life, yet unquestionably, a knowledge of some of the facts relating to sanitary science in its relation to public health would be of the greatest value to every person, for in our individual, family, or social relations, every person is sooner or later brought face to face with the problems presented by epidemic disease; and if anywhere timely action is ever needed, it is just in such a connection as this, where procrastination through ignorance or otherwise may lead to wide spread death.

The statement is often made that our forefathers got along well enough in the good old days when a lack of knowledge concerning germs and bacteria did not disturb their peace of mind, but it may not be out of place to consider that while our forebears were able to exist, for a time at least, that great multitudes of their fellows failed to live the usually allotted span of life. Not only has the annual mortality rate been reduced to one-third or one-fourth of what it was two or three centuries ago, but the average length of life of the individual has been consequently prolonged. Some of this benefit comes from a general improvement in hygienic conditions that has affected all classes of disease, but the most marked reduction has been with those diseases that are communicable from person to person either directly or indirectly.

Recognizing the desirability of introducing the elements of public hygiene into our public school system, how best can it be

done? At the present time, in the majority of cases, the public school teachers have had no direct training that would fit them for this work, and hence instruction in the subject must be more or less handicapped. But it is proposed to overcome this difficulty in part by supplying teachers with the necessary data that will enable them to make a beginning in this direction. This with collateral reading in reference books cited, will give the energetic teacher, a basis on which further development of the work is possible.

It is a question whether the work referred to should be considered as a class room topic, or whether it would not be more advisable to put it in the category of subjects considered in the general exercises of the school. Both methods have certain advantages, and it should probably be left to the individual teacher to decide where the work can be most successfully presented.

In the brief outline which is appended, no effort will be made to treat the subjects considered in anything more than an elementary manner. Particular emphasis is to be laid on those points that have the greatest practical bearing, so that the relative importance of such knowledge may be strongly impressed on the pupils. References to articles may also be found in much of the popular magazine literature of the day which may serve as collateral reading for the teacher.

Inasmuch as this movement is along somewhat unusual lines for the secondary schools, a considerable amount of energy must be expended to overcome the inertia that any new line of work is forced to meet. It is therefore to be hoped that teachers who believe that such matter should be brought before the pupil in an emphatic way will give some time and thought to the presentation of this subject in their schools. In our sister state, Michigan, a somewhat similar treatment is now made compulsory by law in all of the public schools, and although the system has only been in operation for a short time, still the good results of the same are already evident.

COMMUNICABLE DISEASES.

H. L. RUSSELL.

Communicable or transmissible diseases are as their name implies maladies that are capable of being communicated or transmitted (directly or indirectly) from person to person. They embrace not only that class of diseases that are popularly known as "catching," but also a number of others that have not generally been included in this class. They differ from other diseases that are due to defects in structure or abnormal physiological activity (as rickets, jaundice, diabetes, etc.), in that the exciting cause is a living organism that gains access to the human body from without in a variety of ways, and develops in the same under certain conditions, causing a disturbance in the normal functions of certain organs and tissues. Inasmuch as the specific organism inducing the disease is generally found more frequently in the tissues of the patient, i. e., the host, or the emanations from his body, it naturally follows that other persons who are susceptible to such diseases will acquire the same more readily if they come directly in contact with the affected person, or with any disease-producing matter thrown off from his body (sputum, feces, urine or material derived from the skin).

INFECTIOUS AND CONTAGIOUS DISEASES.

Diseases that are readily contracted by direct contact with the affected individual are frequently known as *contagious* (smallpox, measles, scarlet fever, and other eruptive diseases common to childhood), as opposed to the more general term *infectious* in which the exciting cause of the disease may be disseminated less directly, as through the medium of air, water, and food. The distinction, however, is an imperfect one, and is

only given here because these words have become common language terms, the exact meanings of which are often imperfectly understood. Typhoid fever and cholera are illustrations of infectious diseases, while erysipelas, diphtheria, and consumption (tuberculosis), may be grouped under either class, according to the conditions governing their spread.

CAUSES OF COMMUNICABLE DISEASES.

Diseases of this class are produced through the introduction of living organisms from without into the body of a person susceptible to the particular disease in question. The invading or specific agent is generally known as the *exciting* cause; the condition of the body as to whether it is susceptible or not, and the effect of external surroundings, the *predisposing* factors of disease. It does not necessarily follow because the specific organism able to produce the disease finds its way into the human body that such a disease will necessarily develop. Whether it does or not will turn upon the resistance which the body offers to it. Thus an adult is generally no longer susceptible to the eruptive diseases incident to childhood. By reason of age, he acquires an insusceptibility; he becomes immune to such maladies.

To a considerable extent, the ability to resist the attacks of disease-producing organisms depends upon the general vitality of the body. Any conditions that tend to lower this vitality, such as improper nourishment, bad ventilation, excesses of various kinds in eating, drinking, muscular exertion, etc., often predispose a person to an attack of some disease. Thus a cold is often a precursor of pneumonia or consumption. It is popularly believed that a common cold may "run into" or develop into either of these two diseases, but the appearance of the more severe malady is often due to the fact that the general vitality of the body, and more especially the lungs, is so lowered by reason of the cold that the specific germs of these other diseases are able

to gain a foothold. This factor in disease is often overlooked, and special emphasis should be placed upon the possibility of preventing or warding off disease by keepng the resisting powers of the body in a state of highest efficiency.

THE EXCITING CAUSE OF COMMUNICABLE DISEASES.

The direct causes of diseases of this class are in the main due to the development of living parasitic organisms that are capable of growing in the body. For the most part these belong to the low forms of plant life known as bacteria. The individual is

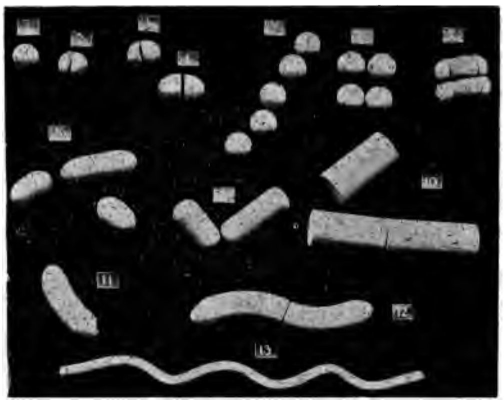

FIG. 1.—Models showing form and relative size of bacteria magnified about 4,000 times:
1, micrococcus as found in boils;
2-4, micrococcus undergoing division;
5, coccus in chains (erysipelas);
6, coccus in tetrads;
7, coccus in packet-forms;
8, typhoid fever bacillus;
9, hay bacillus.
10, anthrax bacillus;
11, cholera vibrio;
12, cholera organism in pairs;
13, spirillum of relapsing fever.

composed of a single vegetable cell that is either round, slightly elongated, or spiral shaped (Fig. 1). In many cases they are able to grow outside of the human body; in other instances they can not thrive except in living animal or human tissue.

There exist in addition to the disease-producing or pathogenic bacteria, a great number of similar forms that are concerned in

the different fermentative processes, putrefaction and decay. These as a class have no pathogenic power, and so far as human health is concerned are quite harmless. In fact, many of them are of direct benefit, in different technical industries, as dairying, farming, and in the manufacture of liquors, acids, and other products. Indeed, in some cases, these organisms are even essential to the continuance of life on the earth.

Some kinds of bacteria are able to form "spores" or seeds by means of which they can retain their vitality for long periods of time, or under conditions generally unfavorable to life. If such spore-bearing species are disease-producing, the danger is much greater than with those kinds unable to form these resistant structures.

MODES OF DISSEMINATION OF DISEASE.

It is of the utmost importance to be able to recognize just how any disease organism is able to pass from one host to another; for it becomes possible to hinder or prevent an enemy's progress very much more readily and effectively if one knows along which route they are most likely to advance. It is only since these facts have been accurately ascertained that it has been possible to institute measures that would effectually destroy the bacteria in question without imposing needlessly stringent precautions in many other ways.

Only a few transmissible diseases are caused by organisms that are incapable of developing or at least existing outside of the tissues of their peculiar hosts. Thus, hydrophobia or rabies can only be produced by the direct introduction of the virus of the disease from one host to another. Hence, no danger exists in this case except where a person is bitten by a rabid or mad animal (dog, cat, etc.).

Unfortunately, most diseases are not so strictly parasitic. The germs causing the same can live outside of their ordinary host for varying periods of time, as in tuberculosis, and in other cases as in typhoid and diphtheria, development can actually oc-

cur. Such diseases are more dangerous to the public because the disease organism is not necessarily associated with the affected person, but may be found in earth, air, or water under conditions that render its detection impossible except by technical means.

Bacteria of disease are also disseminated by means of either air, water, or food. Such diseases as mumps, measles, scarlet fever, chicken pox, smallpox, and tuberculosis are spread by means of the air. In the case of the eruptive diseases, the fine dust-like scales that arise from the surface of the body are able to transmit the disease, and as these are especially liable to be distributed by air currents, it generally happens that infection in these cases arises in this way. The organism of consumption is found in large quantities in the expectorations from the lungs, which, in a dried condition, are readily inhaled.

Other diseases like typhoid fever and cholera are distinctively water-borne maladies, the organisms causing the same finding their way into drinking-water supplies in various ways, and so passing in an indirect manner from one host to another. Food supplies, particularly milk, may serve as a good food medium for the development of disease organisms like typhoid fever, scarlet fever, and diphtheria. The fact that milk is generally consumed in an unboiled condition increases the danger from this source.

PLACE OF ENTRANCE OF DISEASE GERMS INTO THE BODY.

Much needless fright is occasioned on the part of many people by a lack of knowledge concerning the ways in which disease bacteria enter the body. These points of invasion are specific for various diseases. In some cases, as in tuberculosis, the disease organism may enter through a number of channels, while in other diseases as typhoid fever or cholera it is established solely in the intestinal tract.

The natural openings and passages of the body, lined as they are with delicate mucous membranes that are more readily per-

meable than the outer skin, afford an opportunity for the establishment of the specific bacteria of disease. Thus, the mouth and nasal passages, leading as they do to the intestinal and respiratory organs, permit of the introduction of bacteria to these tissues. Naturally those organisms that are disseminated in a dried condition in the air find their way into the lungs through the ordinary processes of breathing. Such diseases as diphtheria, scarlet fever, and consumption are unquestionably contracted in this way.

Other diseases as typhoid fever, dysentery, and cholera are distinctively intestinal; and, hence, are taken into the body by means of the water or food that is consumed. The germs of these diseases have no power to travel through the air, and can not establish themselves in the breathing organs; therefore, there is no need of fear of contracting such diseases through the air.

Diseases that establish themselves through the food consumed can be guarded against very readily, for by thorough cooking and preparing the food it is possible to destroy all germ life, and by proper filtration of the water all danger of water-borne disease can be eliminated. Those contracted through polluted air are very much more difficult to check.

Some diseases enter the body through wounds or cuts in the skin. Lock-jaw, for instance, is almost always contracted in this way. A wound from a rusty nail or a toy pistol often serves as the means by which the disease organism is forced into the susceptible flesh. The germs causing boils and abscesses also enter the body frequently in this way.

The following summary of the more important diseases and the manner in which they are disseminated and the way in which they gain access to the body is herewith appended.

Mode and place of invasion of various transmissible human disease and the period of incubation of same.

	Part of Body Affected.				Period of Incubation.
	Skin.	*Air passages.*	*Digestive tract.*		
	Cuts, bruises, wounds, bites.	Breathing.	Food.	Water.	
Tuberculosis........	+*	+++	++	....	Several mos.
Diphtheria..	....	+++	++	....	10 days.
Pneumonia..........	....	+++	....	....	
Typhoid fever.......	....	....	++	+++	9-20 days.
Cholera...............	....	....	++	+++	3 hrs.-5 days.
Bubonic plague.....	+++	+++	+ ?	....	6 days.
Lock jaw..............	+++	....	....	....	
Hydrophobia.........	+++	....	....	....	1 mo.-1 yr.
Malaria	+++	....	....	....	
Grip (influenza).....	....	+++	....	....	12-14 days.
Small pox...........	....	+++	....	....	1-7 days.
Scarlet fever........	....	+++	++	....	5-10 days.
Measles..............	....	++ ?	....	....	12 days.
Mumps...............	....	++ ?	....	....	15 days.
Whooping cough....	....	++ ?	....	....	2-10 days.

*The sign + is used to denote the relative importance of different methods of invasion; +++ indicates the most common method; ++ and +, the less prevalent types. Where ? is added, it signifies that the causal organism producing such disease has not been discovered, and therefore the exact method of invasion has not been actually demonstrated; but from the ordinary method of development of the disease, it is practically certain that invasion occurs as represented.

TREATMENT OF DISEASE.

This is the all-important question, and the one toward which the most earnest endeavors of medical science are now directed. Often, however, treatment of any kind in some diseases is unavailing. In any event, the question as a whole is one that pertains more strictly to medicine, and hence calls for the services of the medical practitioner.

On the other hand, certain phases of the question should be thoroughly understood by the public at large.

The best way to treat these communicable diseases is to be-

gin before the disease makes its appearance, i. e., prevent them. Not infrequently, they are as a class called preventable diseases, because they can be prevented by measures that are entirely feasible. The only reason, therefore, that they exist as a menace to civilized society is because the masses are either ignorant of the way in which they can be prevented, or are careless and indifferent as to whether they are prevented or not. It is very difficult to make people take precautions against future dangers, and for this reason the lessons of sanitary science are often unheeded by those who are most likely to be affected. From any point of view, financial, economic, humanitarian, or otherwise, it is the part of wisdom to prevent the occurrence of diseases of this class, not only in their epidemic form, but the sporadic cases as well. Hundreds of thousands of lives are annually sacrificed because of negligence in these matters. As a rule, the masses are ignorant of effective measures, and do not realize the importance of timely action, until, alas! it is often too late. A realization of this fact is the strongest possible reason why elementary education in such matters should receive attention in our public schools.

PREVENTION OF DISEASE.

One of the most essential things in the prevention of disease is to acquaint the individual with exact knowledge concerning the habits of disease organisms. The discovery of the specific organisms concerned in the production of many transmissible diseases has thrown a flood of light on this whole subject. It is much easier to successfully attack an enemy whose position is known and defined, than one that is hidden in ambush. Until the absolute demonstration of the accuracy of the germ theory of disease by the determination of the causal relation that certain specific microbes hold to certain disease processes, no scientific methods of combatting disease by preventive measures existed. The restrictions thrown around individual action in isolation and quarantine were needlessly severe; and no discrimination

was exercised between some diseases, the contagiousness of which was subject to much variation. The very term, quarantine, signifying forty, indicated the number of days for which detention was necessary to prevent the dissemination of, not only the plague, but other violently infectious maladies.

Keeping in mind the fact that disease bacteria are not universally distributed throughout nature, but are more or less aggregated in those places where affected persons may happen to be, it is possible to prevent in a great measure, the spread of disease by directing the attempts made to destroy these seeds of contagion to those locations in which disease matter is most likelv to be present.

DISINFECTION.

The means which have been found to be most efficacious in the destruction of bacterial life, i. e., disinfection outside of the body, rest upon the application of either physical or chemical agents. Of physical agents heat is the most effective. While cold retards and finally checks all bacterial growth, disease matter is not destroyed with certainty even when a freezing temperature prevails. On the other hand a temperature of 130° F. and above will thoroughly kill all kinds of germ life. Moist heat, as in the case of steam destroys more rapidly than dry heat, as in an oven. Articles of clothing and objects not injured by exposure to water can be readily disinfected by boiling in water for 15 to 30 minutes.

In many cases disinfection can be more advantageously performed by the use of chemical agents. These may be applied either in a liquid or gaseous condition. In the disinfection of excreta, expectorations or any emanations from the patient, liquid disinfectants as corrosive sublimate, carbolic acid, and formalin are preferable. Where spaces such as sick rooms, infected houses, etc., are to be disinfected, some gaseous disinfectant, as the gas from burning sulfur or formalin* can best

*Formalin is the common trade name of a 40 per cent. watery solution of the powerful disinfectant, formaldehyde gas.

be used, if the room can be tightly closed to prevent the escape of the volatile gas. Sulfur to be efficient must be burned in large quantities and in presence of moisture. The common practice of burning a handful or so on a pan for a few minutes has little or no effect on disease bacteria.

PREVENTIVE INOCULATION (VACCINATION).

The use of chemical and physical agents enables one to destroy the bacteria of disease *outside* of the human body, but these agents are ineffective after the organism has once obtained an entrance. In the case of a few diseases, methods have been devised that enable one to prevent the virus of the disease from acting in its normal manner. Also methods have been found that permit of the increase in the resisting powers of the body for a time at least (artificially acquired immunity), so that during periods of special danger, the resistance of the body can be temporarily increased. These methods of vaccination and inoculation afford examples of the most striking instances of the advances which have been made in modern medicine. Generally, they are more available for individual protection than for the masses; for as a rule it is not possible to induce people in general to employ preventive inoculation except in times of danger.

In combatting disease greater stress however should be placed upon the use of chemical disinfectants so that morbific matter may be destroyed before other persons are infected. With the wider use of such methods and their more efficient application, epidemics of disease are becoming more short-lived. These general protective measures are to the preventive inoculation of the individual, what the heavy siege artillery is to the weapon used in a hand to hand fight. Much can be done in fighting off disease by the use of these disinfection measures, now that the lurking places of most disease organisms have been ascertained. However, when these means have failed, there is yet to be used in some cases, the last resort—preventive inoculation. In such

diseases as smallpox and hydrophobia, preventive inoculation is practically a specific, a sure cure, if timely administered. Where compulsory vaccination is enforced as in Germany, the disease of smallpox has become so rare as to be a medical curiosity. (See Fig. 2.)

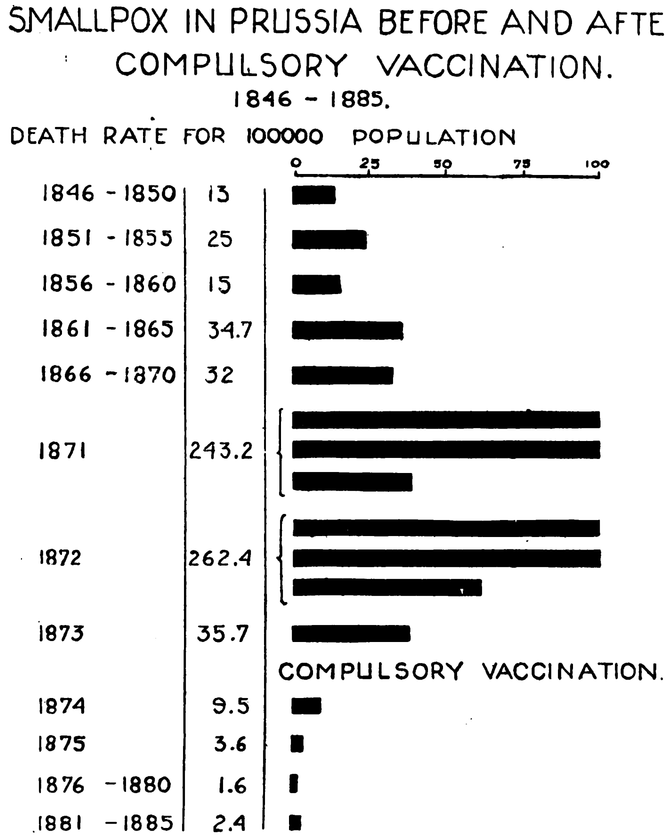

Fig. 2.

In other countries where laxity prevails in regard to protective vaccination, the disease is often a general menace. The history of the disease in Porto Rico, for example, is a splendid illustration of what modern sanitary methods can do. Before the occupation of this island by the United States, this disease was endemic, i. e., permanently established throughout the country, as was also the case with the same disease and yellow

fever in Cuba, but with the improvement in sanitary conditions incident to the American occupation, there did not exist, at the time of a recent report of the Superior Board of Health of Porto Rico, a single case of smallpox.

Hydrophobia is another disease that has been practically conquered through the introduction of the Pasteur treatment of protective inoculation. (Fig. 3.) This treatment cannot be so universally administered as that for smallpox, but its efficiency is

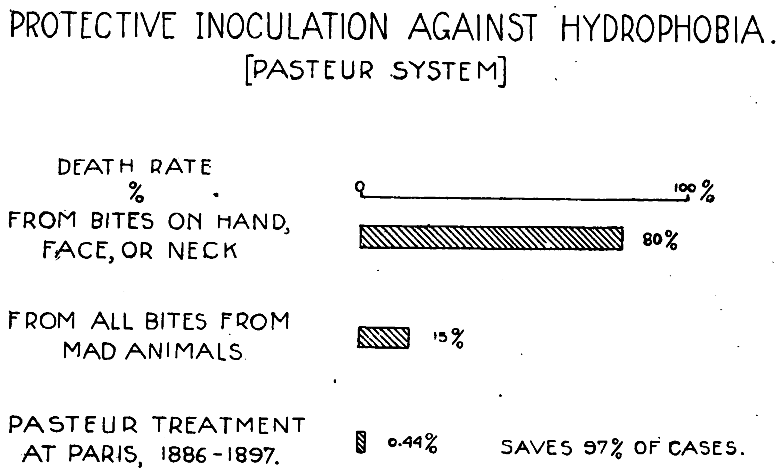

Fig. 3.

wonderful as it has robbed this disease of practically all of its victims; for the results of the protective inoculations made at the different institutes show a mortality of less than one-half of one per cent. The best results obtained with this treament as with all others of a similar character, rest upon a timely administration of the remedy. After the tissues have once been destroyed nothing can stop the effects of disease. This point is often unappreciated by the public.

The principle recently introduced of using antitoxins in fighting disease is an advance on even protective inoculation. From the blood serum of a horse that has been rendered artificially immune to certain specific diseases like diphtheria, lock jaw, and erysipelas, it is possible to secure a substance that has not only the power of preventing a person from acquiring the

disease in question, but in the earlier stages of the disease it also possesses the strongest curative properties, (see section on diphtheria for further discussion). This crowning discovery of scientific medicine has opened up a new field, the boundaries of which no one can determine at the present time. In its action it accentuates the method of healing that Nature herself uses, and the diminution in death rate in the case of this disease alone—diphtheria—makes it the greatest life saver of the age.

Although the science of bacteriology is yet young, it has given to the world discoveries that are of the greatest consequence; but the full fruition of these can never be realized until the masses are thoroughly acquainted with their use; until they appreciate the importance of knowing enough of such matters so as to realize the actual danger that does exist in the case of different transmissible diseases. In dealing with diseases of this class, the greatest danger comes from ignorance and apathy, but if the public at large understand the uses that can be made of these bacteriological methods of treatment, and above all, the absolute necessity for timely action, the grim specter of contagious disease must certainly give way in large measure before an intelligent public.

The general principles of disease, their origin and modern methods of treatment have been amplified at some length so that the teacher might gain a better insight into the general nature of the subject. To emphasize these principles in the minds of students, it is necessary to be more concrete, and for this purpose the following summary of some of the more important infectious diseases is appended. By the use of tabular and graphical data, it is hoped that the leading facts presented may be brought before the student in a way, so as to impress him with their importance in a manner that may be of service to him later in life in his individual, family or social relations.

TUBERCULOSIS.

H. L. RUSSELL.

The fear of the human race against contagious disease generally turns on the rapidity with which the disease "runs" its course, and the percentage of fatal cases. A disease like the bubonic plague that reaches a favorable or a fatal termination in a few days, and one in which the mortality rate is exceptionally high strikes terror to an affected community. But if the number of lives sacrificed is extended over a longer period of time, even though the disease may be constantly present in our midst, the human mind becomes accustomed to its presence and its steady ravages, and fails to be awakened to the necessity of immediate and strenuous action. A loss of 2,500 lives every year in the limits of our own state is a fearful price to pay for the presence of any scourge.

A forest fire, a cyclone or a flood may wipe out of existence a town or so, once in a decade. A disaster like the Peshtigo fire, or the New Richmond cyclone or the Johnstown flood only comes a few times even in a generation; but the sympathy and active co-operation of a state or nation are given in such a case. But every year, in this state alone, we pay the price of two thousand five hundred lives that are blotted out by this disease,—a loss that far exceeds in the aggregate that produced by war, fire, famine and flood.

Tuberculosis, and especially that phase of the disease that is commonly known as consumption, leads the death list of communicable diseases, the average death rate for temperate regions ranging from 10–20 per cent. The loss from this disease alone is fully four and one-half times as great as from smallpox, diphtheria, scarlet fever and typhoid fever combined. On an average, one out of every seven persons that die fall a victim to this "great white plague." Dr. Osler of the Johns Hopkins

University places the total number of consumptives in America at 1,200,000, an estimate based on the relation of deaths to cases reported.

The following data (Fig. 4) compiled from the Massachusetts vital statistics show the comparative death rate of the more important transmissible diseases for the last twenty years.

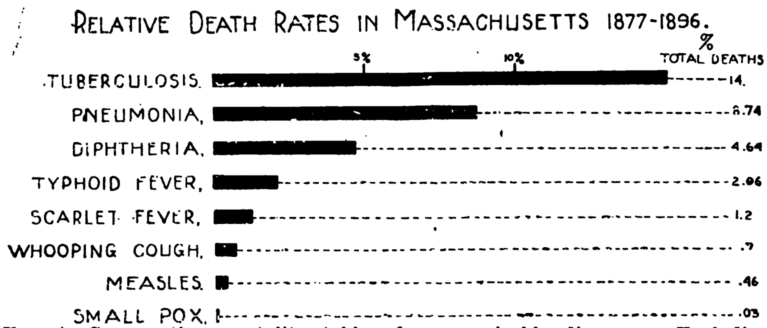

FIG. 4.—Comparative mortality table of communicable diseases. Excluding pneumonia, the loss from tuberculosis is greater than from all other communicable diseases.

Not only does the loss from this disease exceed that due to any other cause but the scourge falls heaviest on the most productive periods of life. The highest mortality is in the prime of young manhood and womanhood, between the ages of 20 and 30 years. Startling as are the facts that one out of seven of the white race die from this disease, yet the death rates are still more striking when taken in relation to the age of those who die from this disease as is shown in Fig. 5.

Almost one-half of tubercular deaths occur between the ages of 15 and 35 years. After a person passes the meridian of life, his liability of contracting the disease is much diminished.

While the data presented represent the relation of this disease to the state at large, yet when consideration is given to the influence of other factors, the real source of danger can be more correctly ascertained.

INFLUENCE OF CLIMATE.

Climate exerts on it a profound effect, a damp region, having generally a high mortality. The percentage of loss is much greater in the seaboard states than in the drier region of the plains and portions of the mountain states. Even in the coast-line states, the death rate varies from the seashore inland, being almost double in Massachusetts on Nantucket Island to what it is in the Berkshire hills. For a similar reason the death rate reaches the maximum from January to May, and is at a minimum during June and July.

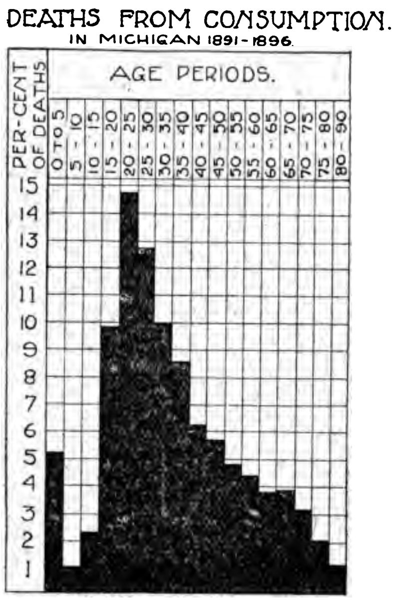

FIG. 5.—Deaths in Michigan (1891–1896) from tuberculosis of the lungs (consumption) at different ages (Mich. Board of Health).

INFLUENCE OF OCCUPATION.

The occupation of the individual is a prominent factor in determining his susceptibility to this disease. Those vocations that confine one indoors have a higher mortality than out-of-door pursuits. Quarrymen are an exception to this, but their increased susceptibility comes from the effect produced on the

delicate linings of the lung cells by the inhalation of finely powdered stone-dust. The danger from dust is seen in the statistics as to the mortality of file-makers, cutlers, printers and drapers, in comparison with vocations that enforce a free out-of-door life (gardeners, farmers, and fishermen).

Influence of occupation on mortality from tuberculosis.

Out-of-door vocations.	Rate per 1000 deaths (all causes.)	Confined vocation.	Rate per 1000 deaths (all causes.)
Farmers	103	Grocers	167
Fishermen	108	Cotton mill operators	257
Gardners	121	Drapers	301
Quarrymen	308	Cutlers	371
		File-makers	433
		Printers	461
		Earthenware workers	473

The influence of close confinement is also strikingly shown in the mortality rate of prisons, insane hospitals, but above all in convents. Cornet found in thirty-eight convents in Prussia that 62 per cent. (1,320 in 2,099) of all deaths for a period of twenty-five years (1864–1889) were tubercular. These institutions were chosen because the inmates remain for life in the same convents, thus eliminating the effect of change in residence. They are, however, required to pass a medical examination upon entrance. The average health at the beginning is therefore good. For the first six months the tubercular mortality is very low, but rises rapidly, reaching its maximum in the third year after entrance.

INFLUENCE OF DENSITY OF POPULATION.

An influence that exerts even a more profound effect than climate is that of density of population. Not only is the disease more common in the city than the country, but it is much more prevalent in those portions of cities (the tenement districts) where overcrowding in illy ventilated, small rooms is apt to oc-

cur. In New York city less than 25 per cent. of total number of buildings contained cases from 1894–1896. In one ward (VI), one of the worst in the city, that including the Italian, Russian, Jew, and Chinese quarters, over 37 per cent. of the houses in the entire ward were affected. In these infected quarters cases often appear with striking regularity year after year, as is evident from Figure 6 which shows the deaths from tuberculosis in a single block for the years 1894–1896.

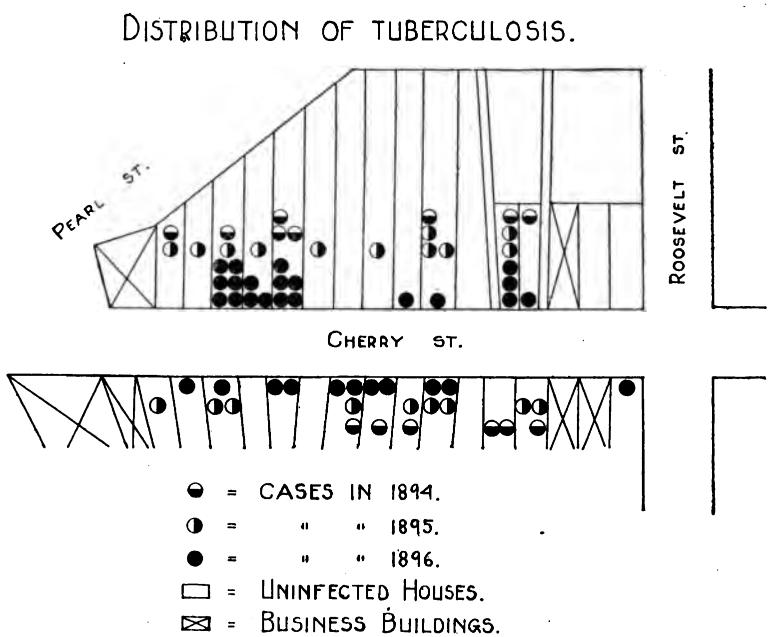

FIG. 6.—Cases of tuberculosis in three years in a single block of buildings in New York City.

SYMPTOMS OF THE DISEASE.

The initial symptoms of this disease are not well marked; hence, it is difficult to recognize it, especially in the beginning stages. It is contracted by breathing in the germs peculiar to it, which lodge in various portions of the respiratory passages, especially in the lungs. If the conditions are such as favor their development, growth of the inhaled tubercle bacilli occurs, causing inflammation which finally results in the production of

tubercles. At first these are local, in which stage a person may often recover even without any treatment. If the disease extends, more and more of the lung tissue becomes involved, and poisons are produced as a result of the growth of the bacteria. The general health of the individual suffers, loss of appetite and general debility occurs, which condition is usually associated with a persistent cough.

Even in the early stages of the disease, the material raised from the lungs contains tubercle bacilli, and these increase as more lung tissue becomes involved and breaks down. This disintegrated matter which is thrown off from the body through the expectorations constitutes the greatest source of danger to other persons.

MICROSCOPIC EXAMINATION OF THE SPUTUM.

The fact that the tubercle bacilli are found in the sputum is of the greatest value in the diagnosis of the disease, for the specific bacilli often appear in this material before there are any physical symptoms that are obvious to the physician. The determination of these organisms in the sputum (which fact can be ascertained with exactness by microscopic examination) is therefore absolute proof of the presence of the disease in the system. Whether the usual fatal termination ensues or not depends largely on the immediate action of individual.

TREATMENT.

Climatic change, especially at certain seasons of the year, from the damp inequable conditions that sometimes prevail in our state to the dry and equable regions of some of the mountain and Pacific states often works positive cures, even in well developed cases, but alas! too often such measures are not resorted to until too late.

Treatment in properly equipped sanitaria in the east and middle states can now be had in many cases. Even with treatment at home by competent physicians, many cases of the more incipient character are helped.

DISSEMINATION OF CONTAGIA.

As the sputum generally contains the disease germ (if the disease is present in the lungs), the disposition of this matter is of the greatest possible importance. Carelessness here is the direct reason why the disease is so widespread. As previously shown, the bacilli of the disease are not uniformly and universally disseminated, but in general are confined to quarters occupied by consumptives. They are not derived from the exterior of the body, or ordinarily from the breath, although in the act of coughing they are often expelled and in the mist-like particles of moisture may float for a time. Under such conditions they dry quickly, and may again be raised in the dust and readily inhaled by other persons. Therefore it is of utmost importance to prevent expectorations from drying. Nothing can be worse than voiding the same into a handkerchief where they are allowed to dry; for then every movement throws them off in the air. Sputa should be voided into a receiver partly filled with a disinfecting solution such as dilute carbolic acid. Japanese napkins afford a convenient way to catch the same; and if these are immediately burned no danger ensues. A thorough recognition of this danger by the individual, a conscientious fulfillment of the simple precaution suggested, removes practically the sole danger from a patient, and thus does away with the necessity of quarantine or isolation.

In the dried condition the bacilli retain their virulence for considerable periods of time (a year or so); hence dust in a house occupied by a patient is a source of future danger and explains why so many cases develop in certain houses, though occupied successively by different families (see Fig. 6).

INFECTION FROM FOOD.

While by far the larger part of tuberculosis is confined to the lungs (consumption), and is contracted by the inhalation of germ-laden air, yet other avenues of infection also exist. The

disease is often found in cattle and other flesh-yielding animals. Not only may the animal itself be infected, but in the case of the cow, the milk is occasionally diseased. The danger from tuberculous meat is minimized by reason of the fact that meat is cooked before being consumed, but such protection is not afforded to milk. How much tuberculosis in man is caused in this way is not yet satisfactorily known, but the probabilities are that a considerable proportion of intestinal tuberculosis, especially that of young children, is induced in this way. As the disease can be readily determined in cattle by employing what is known as the tuberculin test, it is easy to eliminate the danger from this source. Milk from cows reacting to this test should not be used for human food, unless it is first boiled or pasteurized.

CONSUMPTION IS NOW DECREASING.

The statistics collected from all countries uniformly show that consumption is now on the decline. Although even at the present time, it leads all other infectious disease in death rate, yet the reduction in the last two hundred years has been very marked. This diminution has undoubtedly been occasioned largely by the general improvement in sanitary conditions, but a further decline in the death rate of this disease is to be noted since the specific measures have been put in operation that tend to check the spread of infectious material. With the determination of the fact that the sputum of the patient is almost the sole source of danger, and with increased care taken to properly dispose of this, the death rates have been still further decreased. Unquestionably, as the public learn to appreciate the value of sputum disinfection, still further improvement may be confidently expected. The record of the last half of this century for representative conditions in Great Britain and America certainly are most encouraging as shown in Fig. 7.

IS THE DISEASE HEREDITARY?

The belief is very general among the masses that this disease is inherited. This notion springs from the idea that the progeny of tuberculous parents is more likely to have the disease than others. Such an idea is however a fallacy, for abundance of evidence exists that conclusively shows that the disease is not inherited as are physical traits. What we may inherit, however, is that peculiar conformation of body that may predispose the system to this disease. Naturally a person with poorly developed lungs that is also sensitive to bronchitis and colds is

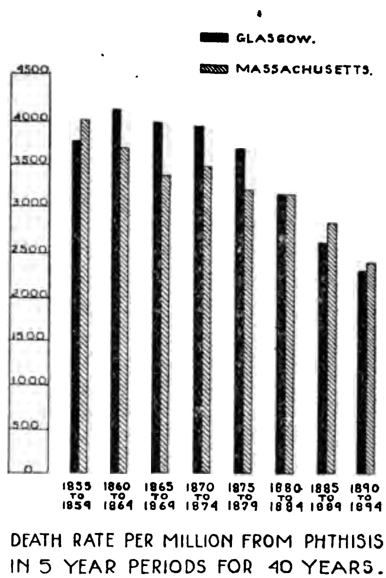

FIG. 7.—Diminution in deaths from consumption in Glasgow, Scotland and Massachusetts from 1855–1895.

more susceptible to this disease than one freer from such tendencies. Such anatomical characteristics are likely to appear in the progeny, and if associated with like tendencies to throat or lung trouble, the physical basis for the disease may be present—the soil is adapted to the development of the disease organism should it make its appearance.

But some will say that the fact that tuberculosis "runs" in families proves the matter of inheritance. Not so. Manifold

cases exist where owing to the death of a parent, the home has been broken up, and the children scattered among relatives. In such cases they are quite as apt to grow up and die from some other disease. If inheritance played the chief rôle, change of habitation would not overcome the hereditary taint. In such instances the young children are taken from a house in which the tubercle bacilli are numerous, and are probably placed in more favorable quarters, so far as danger of tuberculous contagion is concerned.

SHOULD THE CONSUMPTIVE BE ISOLATED?

While tuberculosis is an infectious disease, great stress must be laid upon the fact that the danger of infection in different diseases varies much. As previously pointed out in the introduction, those diseases produced by organisms that are disseminated through the air are more readily contracted than those distributed by food or water. Tuberculosis is generally an air-borne disease, but the disease-breeding material is practically confined to the expectorations from the affected lungs. If these are carefully attended to, little or no danger need by apprehended from the individual himself. As Cornet says, "The consumptive himself is almost absolutely harmless, and only becomes harmful through bad habits." The danger of contracting the contagion is undoubtedly greater in the neighborhood of an affected person, but not necessarily so. If the sputum is not allowed to dry, if it is caught in a vessel filled with a disinfecting solution, or effectually disposed of by burning, the danger from the individual is greatly minimized. The patient should at all times cover the mouth with a napkin or handkerchief during coughing, as the fine nebulous spray that is forced out of the lungs at this time may frequently carry tubercle bacilli several feet from the patient.

It is evident that the danger of contagion can be wholly eliminated in the case of this disease in a very simple and effective manner, and therefore there is by no means the necessity of

isolation that there would be in the case of scarlet fever or small-pox. However, the introduction of tuberculous sanitaria is unquestionably advantageous, as it permits of more satisfactory treatment and minimizes the danger of transmission through negligence and ignorance.

DIPHTHERIA.

W. D. FROST.

Diphtheria (from Greek word meaning skin) is usually characterized by the presence of a skin or membrane in the throat.

Diphtheria under various names has been known from the remotest antiquity and was formerly one of the most dreaded diseases of childhood. Its ravages in recent times are indicated in the following tables:

Average death rates per million of the population in England and Wales, and London from 1856–95.

	England and Wales.	London.
1856–65	246.9	225.4
1865–75	124.8	123.5
1875–85	129.0	176.7
1885–95	210.6	421.4

Average death rate per million of the population in the city of Chicago, 1851–1896.

The death rate of diphtheria compared with other communicable diseases is shown in Figure 4.

INFLUENCE OF PREDISPOSING CAUSES.

Diphtheria, unlike many diseases, can occur in any climate. It is, however, most common in the temperate and cold regions of the earth. As there is no racial immunity it is now very widely distributed, practically world-wide. Not only does it assume an epidemic form, the epidemics varying greatly in extent and severity, but there is a tendency for the disease to persist in certain localities, i. e., to become endemic.

It is most common in the colder seasons of the year, reaching a maximum in November and December. (See Fig. 8.) This is probably due to the increased susceptibility of individuals at this season of the year incident to sudden and marked changes of the weather and the influence of colds upon the general health.

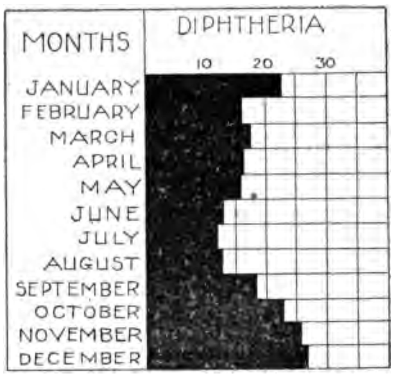

FIG. 8.—Seasonal distribution of diphtheria (Abbott).

Diphtheria is distinctly a disease incident to children and rarely occurs among adults, owing to the fact that they become insusceptible by reason of age, except in cases of much reduced vitality. Adults sometimes have what appears to be a simple sore throat which in reality may be produced by the genuine diphtheria germ. Such cases are of especial danger because they can serve as transmitters of contagion.

The disease usually attacks those between the age of one and fifteen years. The period of greatest mortality is that from one

to five years, while the period from five to ten years has a mortality much higher than that of the succeeding five year period.

Deaths in New York City from diphtheria (Billings).

Under 1 year	7.2 per cent.
1-5 years	65.6 per cent.
5-10 years	22 0 per cent.
10-15 years	2.1 per cent.
Over 15 years	2.2 per cent.

From one to three years of age statistics show that males are more susceptible than females; after the third year the females are more susceptible.

EXCITING CAUSE.

The disease is caused by the development in the throat of a bacterium that is known as the bacillus of diphtheria. This micro-organism grows on the mucous membrane of the throat and nasal passages, producing there a poison which is absorbed by the system and which is the cause of the great depression associated with the disease. The germ is rod-shaped, about 1-8,000 of an inch long and 1-25,000 of an inch wide and like all bacteria has the power of very rapid multiplication. Stained and examined under the microscope, it has quite a characteristic appearance and can be readily identified by a bacteriologist. Not only does the germ thrive in the body but it will grow under certain conditions in sterile beef broth and blood serum, and because of its luxuriant growth on these artificial media, it is possible to readily detect the germ on the one hand, and on the other to produce a most efficient curative agent—the antitoxin of diphtheria.

The bacillus of diphtheria may produce diphtheria alone, but is frequently associated with other micro-organisms, especially with one that is the frequent cause of tonsilitis, and such cases of mixed infection are usually very severe and difficult to treat,

CHARACTER OF THE DISEASE.

As already intimated the disease is characterized by the formation of a false membrane in the throat. This is caused by the growth of the bacteria and consists largely of excreted fibrin in which are entangled the bacteria, dead tissue, and pus cells. The growth is sometimes so great as to partially or completely obstruct the air passages, in which case danger from suffocation exists. This may be prevented, however, by the insertion by the physician of a tube (intubation).

The general symptoms of the disease are caused by the absorption of the poisons (toxins) produced by the bacillus of diphtheria. These poisons are especially liable to attack the nerves that control the involuntary muscles, e. g., those of the heart. Hence heart failure is a frequent cause of death.

RELATION OF DIPHTHERIA TO OTHER KINDS OF SORE THROAT.

It is sometimes very difficult to determine whether or not a particular case of sore throat is one of true diphtheria or not. In fact it may frequently occur that what is supposed to be simply a case of ordinary sore throat is a mild case of diphtheria, and quite as dangerous to public health or even more so than a well marked case of diphtheria because of the lack of treatment and control. Again, cases pronounced membranous croup are usually nothing more or less than cases of diphtheria where the membrane has been formed in the larynx.

It is possible, however, to determine with almost absolute certainty whether a given case is one of true diphtheria or not by means of a bacteriological examination, and the results from such an examination can be obtained usually within 24 hours from the time the material from the throat reaches the laboratory.

Knowing this, it is incumbent upon mothers, teachers and others having young children in charge to have all cases of severe sore throat examined, and this should be done as early as

possible for two reasons; first, because if the disease is diphtheria the earlier the curative treatment (antitoxin) is given the greater the chances of recovery (see Fig. 9), and second, if a case of diphtheria is early recognized as such and isolated, other cases in the same family or school may be prevented more readily.

METHOD OF MAKING A BACTERIOLOGICAL DIAGNOSIS.

It must be borne in mind that a mere physical examination of the throat is not sufficient as the characteristic sign, the false membrane, may be wanting or may have been very slight and have disappeared entirely before the examination is made. The method of making a bacteriological examination is very simple and usually not difficult in the hands of a skilled physician or bacteriologist.

A sterile swab made by twisting a pledget of absorbent cotton on the end of a tooth pick or a piece of wire and sterilizing the same in an oven is rubbed over the suspected area in the throat and then in turn smeared over the surface of a special culture medium, sterile beef blood serum (made after a special formula). In this way any bacteria in the throat are transferred to a culture medium that is especially favorable for their growth. The outfit is now sent to a laboratory and kept for 12–18 hours at the temperature of the human body. The growth which takes place in this time is now examined under a microscope and the diphtheria bacterium, if present, can be recognized by its characteristic appearance.

PERSISTENCE OF THE BACILLUS OF DIPHTHERIA IN THE THROAT OF CONVALESCENTS.

The usual quarantine period is three weeks. That this is not always sufficient will be shown below and that it is sometimes longer than necessary is entirely possible.

Bacteriological examinations of the throat of patients during convalescence have shown that the germ sometimes persists for a very long time after recovery from the disease. Reports have

shown in certain cases the continued presence of the germ 5, 6, 16 and even 19 months after recovery, and quite frequently they have been found present for shorter periods. This teaches us the important lesson that not only ought a bacteriological examination of the throat to be made at the beginning of illness to determine definitely the character of the affection, but it is also desirable after recovery to ascertain whether or not the throat is free from the germs of diphtheria, and hence whether or not it is safe to have the patient mingle with the well, because it must be remembered that the germs in these cases are able under favorable conditions to produce infection in susceptible persons.

DISSEMINATION OF CONTAGIA.

Evidently, in the light of our present knowledge, the germs of diphtheria in order to produce infection, must pass from the sick to the well. The germs leave the body in a living condition, principally through the mouth. By coughing or sneezing these may be forcibly ejected and be breathed in by another person. Doctors and nurses have been known to contract the disease when the patient has sneezed in their faces. More frequently the bacteria, in particles of mucus, lodge on articles of clothing, bed clothes, furniture, and even the walls and floor of the sick room, where they become partially or completely dried, and in which condition may more readily reach a susceptible person; for it has been shown by experiment that the life of the diphtheria germ can be maintained for days and even months in a perfectly dry condition. Children's toys are often the means of spreading the disease. Public funerals have also been a frequent means of disseminating the contagion and are now prohibited in most states.

A number of epidemics are on record where the germ has been carried in the milk supply; in such cases the milk becomes infected indirectly, as in the dairyman's household and not from the cow directly, as the claim made by some authorities that the cow suffers from diphtheria has not been proven.

There is evidence that the cat suffers from the disease and it is quite possible that the contagion may be spread in this way.

The generally accepted idea that sewer gas is the exciting cause of the disease has no experimental basis of support.

INFLUENCE OF SCHOOL ATTENDANCE UPON THE SPREAD OF DIPHTHERIA.

There can be no doubt that school attendance has a powerful influence on the spread of the disease for the following reasons: First. Large numbers of children, at the most susceptible age, are brought together and thus increase the possibilities of infection. Second. The children are brought into close proximity. Third. The use of a common drinking cup, the exchange of sweetmeats, and the habit of promiscuous kissing are important agents in the distribution of the disease. Fourth. The pernicious custom, in some schools where material is furnished the pupil, of collecting slate and lead pencils at the close of an exercise or day's work, to be indiscriminantly distributed the next day has been shown to be fraught with direful possibilities of infection. The New York City Board of Health a few years since made an examination of slate pencils used by diphtheritic patients and found that the specific germ of the disease generally persisted on the same for at least 24 hours, and in some cases for several days (14 days in two instances). The danger of the promiscuous use of such material is therefore very evident.

PREVENTION AND CURE.

As means of prevention the following measures should be enforced:

(1) Bacteriological examination of all suspected cases as well as all suspicious cases of sore throat.

(2) Isolation and quarantine of all cases of diphtheria. It is desirable that the patient be isolated until the throat is known to be free from the bacillus of diphtheria. (See Fig. 9.)

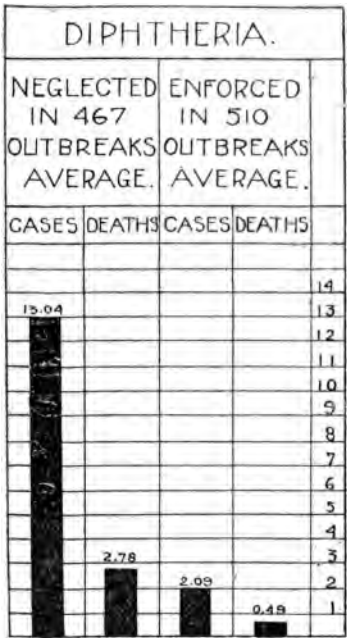

FIG. 9.—Effect of isolation and quarantine in diphtheria epidemics (Mich. Board of Health).

(3) Thorough disinfection of the apartments to which the patient has had access. In case of death, funeral to be conducted under the supervision of the Health Officer.

(4) All persons known to be exposed should be closely watched for symptoms. Antiseptic throat washes should be used, e. g., listerine or mercuric bichloride (1:10,000), and where practicable, prophylactic (preventive) doses of the antitoxin of diphtheria should be used.

In cases of diphtheria the experience of the last few years with the use of antitoxin makes the neglect to use it almost a crime.

ANTITOXIN, THE NEW CURE FOR DIPHTHERIA.

The antitoxin of diphtheria is prepared by growing the germ of diphtheria in beef broth at the temperature of the body for a week or more or until the fluid becomes saturated with the poison produced by the micro-organism. The bacteria are then

all filtered out and a small quantity of the filtrate injected beneath the skin of a horse. Even a few drops at first make the horse quite sick, but it soon recovers and is then able to stand a larger dose. By repeated injections of increasingly larger doses, a tolerance or immunity is built up so that very large doses, a pint or more of the same virulent broth may be injected without apparent inconvenience to the horse. When the animal has reached this condition the jugular vein is tapped and a gallon or so of blood is drawn under aseptic conditions and set aside to clot. The loss of blood does not seriously inconvenience the horse, and many animals continue to give periodically a large amount of blood and hence are extremely valuable.

The serum which rises to the top is light straw colored and contains the antitoxic principle. Its antitoxic strength varies with almost every lot and must be accurately determined. This is done by inoculating guinea pigs with mixtures in varying proportions of the antitoxin and toxin of diphtheria.

It is essential in the use of the agent that it be administered in the early stages of the disease, as is shown in the following diagram, Fig. 10, where the mortality on different days is indicated.

This would be expected because its actions is simply to neutralize the poison, and it has no power to repair injuries to the tissue should these have taken place.

As to the value of the antitoxic treatment stronger words are scarcely possible than those which follow:

"It matters not from what point of view the subject is regarded, if the evidence now at hand is properly weighed, but one conclusion is or can be reached,—whether we consider the percentage of mortality from diphtheria and croup in cities as a whole, or in hospitals, or in private practice, or whether we take the absolute mortality for all the cities of Germany whose population is over 15,000, and all the cities of France whose population is over 20,000; or the absolute mortality for New York City, or for the great hospitals in France, Germany and Austria; or whether we consider only the most fatal cases of

diphtheria, the laryngeal and operative cases; or whether we study the question with relation to the day of the disease on which treatment is commenced, or the age of the patient treated; it matters not how the subject is regarded or how it is turned for the purpose of comparison with previous results, the conclusion reached is always the same, namely, there has been an average reduction of mortality from the use of antitoxin in the treatment of diphtheria of not less than 50 per cent., and under the most favorable conditions a reduction to one-quarter, or even less, of the previous death rate. This has occurred not in one city at one particular time, but in many cities, in different countries, at different seasons of the year, and always in conjunction with the introduction of antitoxic serum and proportionate to the extent of its use." (Biggs and Guerard.)

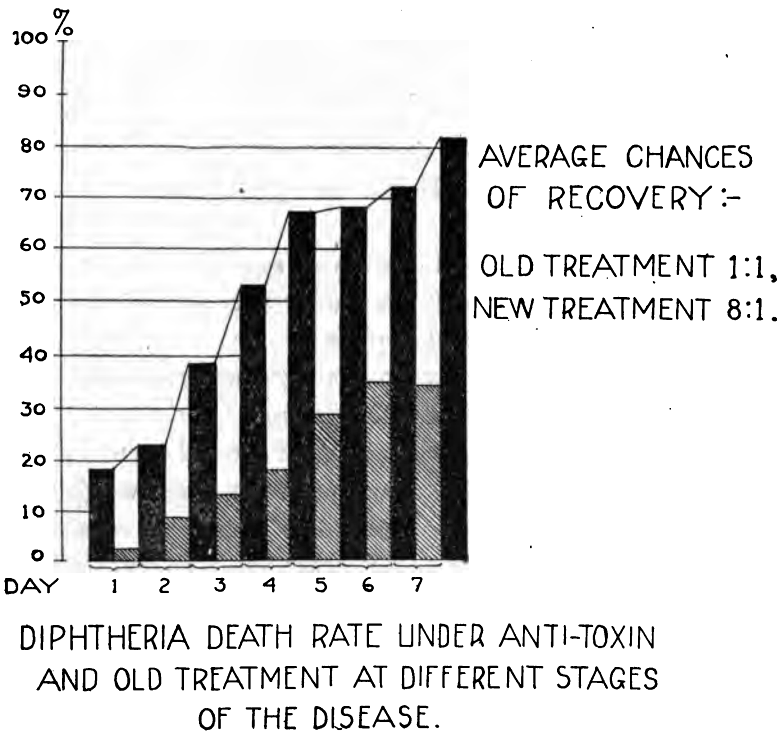

FIG. 10.—Mortality under old treatment shown in black; under antitoxin treatment shaded.

The amount of antitoxin to be administered varies with the severity of the case and the age of the patient. It is much better to give more than is needed than not enough, as the administration of even very large doses produces no undesirable result except at times a rash at the point of inoculation.

In a general way it may be stated that the dose varies from 1,000 to 4,000 antitoxic units. Children under two years of age 1,000 units, children over two years 1,500–3,000 units, depending upon the severity of the case. The dose may be repeated, if necessary.

Diphtheria antitoxin may also be used to protect children that have been exposed to the disease. Such immunity is conferred by the administration of relatively small doses and the protection so produced persists for a number of months. It is important to remember that antitoxin is relatively unstable and that the deterioration sometimes amounts to 10 per cent. per month. Hence only freshly prepared, or tested, antitoxin should be used.

TYPHOID FEVER.

H. L. RUSSELL.

It has previously been shown that some communicable diseases find their way into the body by means of the air that is breathed, while others enter through the food or drink. Of this latter type typhoid fever is a striking example.

While the losses from typhoid fever are not as great as from a number of other communicable diseases (Fig. 4), still its widespread distribution shows the thorough way in which it is established in the civilized regions of the earth.

Generally typhoid fever is a disease incident to the fall months of the year, the major portion of cases occurring from August to November, inclusive. The period of incubation ranges from ten days to three weeks. Of course, when epidemics break out at other portions of the year, they may rage with quite as much severity as in the fall, but generally speaking, the preponderance of outbreaks occurs in the latter part of the year.

The disease is one toward which young adults are peculiarly susceptible, the liability to the same being at least four times as great under twenty years of age as over thirty.

In common with other communicable diseases, typhoid fever belongs to what may be called the preventable class, for it is much easier to control the distribution and spread of disease-bearing matter if it is contracted through the food or drink than it is where absorbed through the air. It is possible to sterilize the food we eat and purify the water we drink, but it would be a much more difficult thing to render germ-free the air we breathe.

Although typhoid fever ought to be one of the easiest diseases to control, yet it is a lamentable fact that the malady is almost continually present in every civilized community of any considerable size, and where carelessness prevails as to sanitary re-

quirements, as is frequently the case in mining or lumbering camps, the disease is often exceptionally severe.

Sporadic or individual cases are of very frequent occurrence, and from time to time epidemics of greater extent break out and rage more or less severely for a period. Rarely does the disease spread as rapidly and widely as cholera, but in many respects this scourge of civilized peoples may be likened to the Oriental disease.

The more or less continual occurrence of typhoid fever in a community tends to make people careless of its presence. While so far as actual loss by death is concerned, typhoid is of subordinate rank, yet the steady and continual sacrifice year by year is very considerable. With a fuller understanding on the part of the masses as to manner of its spread, and the more complete exclusion of the sources of probable danger, the death losses from this disease are constantly diminishing; but even yet, there is a great opportunity for improvement.

The following data compiled from the vital statistics of Massachusetts show the average percentage of the disease, and it is especially noteworthy as indicating the marked diminution within the last decade or so.

Typhoid death rates per 10,000 population (Massachusetts):

1871–1895	8.2
1876–1880	4.6
1881–1885	4.82
1886–1890	4.16
1891–1895	3.25
1896–	2.77
1897–	2.37

It must be borne in mind that while the actual death losses are perhaps relatively small (1–3% of all deaths), yet this does not in any way measure the amount of typhoid fever present in any community. Generally speaking, the ratio of deaths to cases averages about 10%, but is subject to considerable fluctuation, ranging from a few per cent. to as high as 20%.

Typhoid fever is distinctly an intestinal disease. The primary point of invasion is in this organ although the germ causing

it may be carried to some other portion of the body. It differs therefore materially from mumps or smallpox in that it cannot be contracted simply by exposure to a patient already affected. The specific germ producing the malady only gains a foothold in the body through the food or drink. Thriving as it does in the intestine, it is not surprising to find the feces from the patient the main source of danger. The urine also contains very frequently the bacilli. As these are the main substances that are thrown off from the patient that contain the seeds of contagion, it is very necessary that the greatest care should be used in the disposal of these wastes. Failure in this regard is the cause of the frequent occurrence of the disease not merely in the sporadic but also in the epidemic form. Carelessness in the disposal of these wastes often results indirectly in the pollution of water supplies or even foods.

METHODS OF DISSEMINATION.

While by far the larger proportion of cases are undoubtedly due to contaminated water, such food supplies as milk may occasionally be the medium through which the disease organism finds its way into the body. In this food substance the conditions of growth are favorable, and if milk becomes infected in any way, as through washing dairy utensils with polluted water, or where it is handled by a person convalescing from or suffering from the disease, the typhoid bacilli are able to multiply greatly.

The opportunity for the pollution of solid foods is, of course, not so great, but under certain conditions this mode of infection is quite common. It was shown by the experience of many of our military camps during the Spanish–American war that typhoid infection was established through the contamination of the food by means of flies. The proximity of the vaults to the mess tents rendered possible the direct transmission of the infectious agent to the exposed food. In several instances outbreaks have been traced to the use of raw oysters that have been "fattened" in brackish waters that had become polluted with typhoid emanations.

Probably the most common mode of infection is through the ingestion of polluted water. This is occasioned by the fact that sewage, private or public, is frequently disposed of in an exceedingly careless manner, so as to pollute sources that may often be used as drinking water supplies. Not only does this often happen in the case of the private individual well, but not infrequently a municipal supply may become polluted through improper sewage disposal of the same or neighboring towns. This often occurs in cities that are situated on rivers, where the

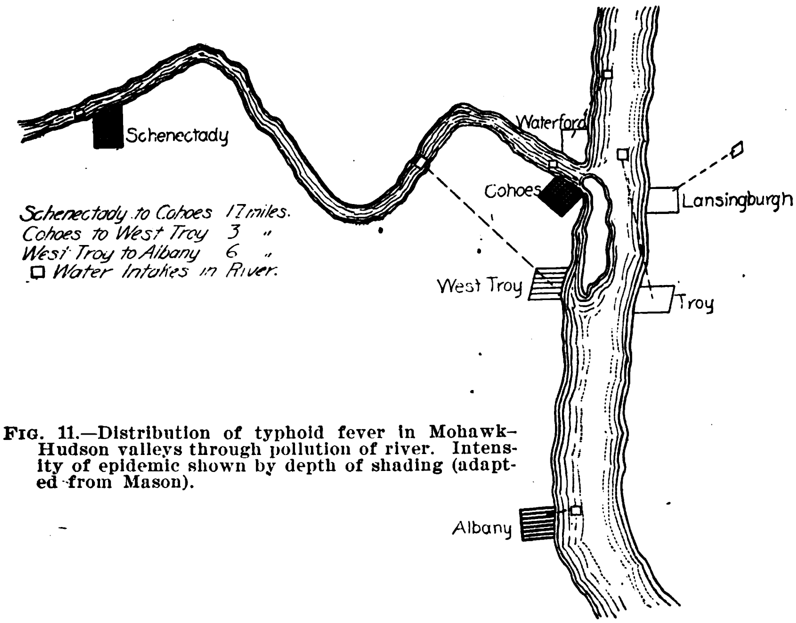

FIG. 11.—Distribution of typhoid fever in Mohawk-Hudson valleys through pollution of river. Intensity of epidemic shown by depth of shading (adapted from Mason).

stream is made to serve the dual purpose of a sewer for one town and a source of water supply for an adjoining town. Numerous instances are on record where an epidemic in a town has been followed by subsequent outbreaks in cities situated below. In the case of the typhoid epidemics in the cities in the Mohawk and Hudson river valleys, this relationship was most strikingly shown by the non-appearance of the disease in Hudson river towns that took their supply above the junction with the Mohawk. (Fig. 11.)

While the larger epidemics in cities are generally connected with impure municipal supplies, yet a great deal of this disease in the aggregate is attributable to polluted wells. Too frequently outhouses are placed in rather close proximity to wells, where the surface or soil drainage from the source of pollution may be directly toward the well. In shallow wells, especially those that are dug and stoned up, the danger of pollution is greatly increased. While this source of danger frequently functions in rural outbreaks, it is by no means confined to the country and village districts. In the congested poorer quarters in cities, old wells are often kept in use long after the density of the population has rendered the soil pollution probable. In 1889 in Washington, 626 fatal cases of typhoid occurred in families using water from about 300 different wells. Is not this a humiliating sanitary record for our capital city?

Sometimes extensive outbreaks have been traced to pollution arising from a single case of the disease, as in the Plymouth, Penn., epidemic, where in a town of about 8,000 people, nearly 1,100 cases of the disease developed in a few months. The city reservoir in this instance was polluted through the storm drainage washing the dejecta into the stream that fed the reservoir.

PURIFICATION OF WATER SUPPLIES.

Coupled with the problem of typhoid infection is another practical question of the purification of water supplies. Recognizing the danger that exists in waters, particularly those of surface origin, how can they be improved and made safe?

So far as the individual is concerned, there are several methods to which he can have recourse, in case that treatment of supply is desirable. The easiest and often the most effective way is to boil the water. Disease bacteria of all kinds are unable to stand this treatment; and even a dangerously polluted water may under these conditions be used with safety.

Another method is to employ some of the better type of domestic filters, such as those made of fine unglazed porcelain or silicious earth. These will eliminate all of the bacteria in

water, and if properly attended to, will insure safety. There are, however, many types of filters that may clarify a water of its turbidity without removing with certainty all dangerous bacterial life.

Modern sanitary science has done much in perfecting the methods of water purification that are now being utilized for treatment of city supplies. The use of sand filters constructed for the treatment of large quantities of water is now being recognized as a safe and efficient way to purify a water supply so as to insure practical freedom from water-borne disease. The experience of every city that has installed adequate purification works of this character that have been efficiently controlled is that the death rate from diseases of this class have been greatly lessened. The instance cited in the case of Zurich, Swizterland, could be confirmed by a large number of other cases in which equally as good results could be shown. (Fig. 12.)

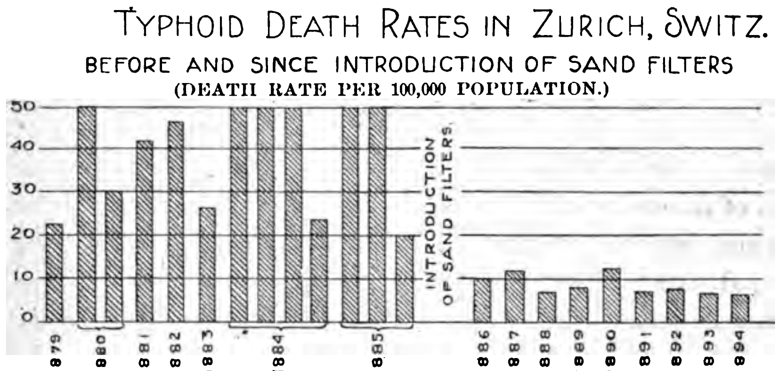

Fig. 12.

DISINFECTION OF DEJECTA.

Inasmuch as the typhoid stools and urine are practically the only substances that are dangerous, it becomes an imperative duty to treat these in all cases so as to destroy any seeds of contagion. This can be readily done by adding to same an equal volume of "milk of lime" solution which may be readily prepared by slaking about 1 quart of fresh quicklime in a quart of water, and then adding to this about three more quarts of water.

An exposure to this disinfecting solution for an hour will thoroughly destroy all disease bacteria.

It is also necessary to disinfect all bedding and garments used by the patient. This can be done by immersion in a dilute carbolic acid solution (3%) or by boiling.

SCARLET FEVER.

W. D. FROST.

Scarlet fever, or scarlatina, is so called because of the color of the rash which with other symptoms, such as high fever and sore throat, characterize the disease. Next to diphtheria it is the most dreaded disease of childhood, largely perhaps because of the sequalae or after effects of the disease, for the direct mortality of the disease is not so high. The mortality in England and Wales from 1855 to 1891 was, in round numbers, 7 per 10,000 population. The mortality, however, varies considerably from year to year. The virulence of the disease also varies greatly in different stages of the same epidemic. The ratio of deaths to total number of cases ranges from 4.2 to 10 per cent. in mild cases, while in severe epidemics it is as high as 15 to 20 per cent.

INFLUENCE OF PREDISPOSING CAUSES.

Scarlet fever occurs in isolated cases or sporadically and in epidemics which vary greatly in severity. It occurs in all parts of the world in its epidemic form and is usually quite uniformly distributed, but strangely enough "some cities have remained free from scarlet fever for thirty and even fifty years, although in constant communication with infected cities" (Levy & Klemp

erer). Some individuals are likewise exempt and this immunity may run in families.

It occurs at all seasons of the year, but is most common in the fall and winter months. It is distinctly a disease of childhood, 50 per cent. of all cases occurring in children under five years of age, and 90 per cent. occurring in children under ten years of age. Infants are rarely attacked. The susceptibility to the disease decreases with advancing years, so that it is a distinct advantage to keep a child from the disease if possible. It is also true that the fatality decreases with age, the fatality being much less in the age period from 10 to 15 years than in the period, including the first five years of life. When, however, maturity is reached the case mortality begins to increase again. This fact, as well as the far greater susceptibility to the disease in the early years of childhood, are well brought out in the following diagram. (Fig. 13.)

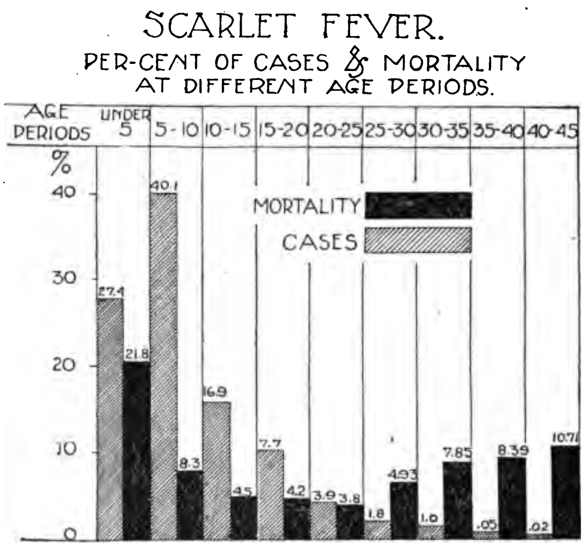

Fig. 13.

The greatest danger in scarlet fever comes from its frequent and extremely numerous complications. Among the most frequent may be mentioned ear and throat complications, inflamma-

tion and degeneration of the kidneys, inflammation of the serous membranes and inflammation of the muscles.

The incubation period is usually about seven days, but may vary from twenty-four hours to two weeks. One attack of the disease, with rare exceptions, leads to complete immunity. "Only 29 cases in all of second attacks and 4 of third attacks are recorded in the literature" of the subject (Levy and Klemperer).

EXCITING CAUSE.

The exciting cause is as yet not definitely known. A considerable number of bacteria have been singled out by various investigators as the causal agents, but at the present time there is no unanimity of opinion in the matter. The frequent concurrence of scarlet fever and diphtheria have led some to believe that there might be some direct relation between the two diseases, but inasmuch as the bacillus of diphtheria is always found in such cases and not in others, it is more probable that diphtheria is simply one of the many possible complications.

DISSEMINATION OF CONTAGIA.

Scarlet fever is highly contagious at all periods of the disease, i. e., from the invasion, or beginning of infection, to the end of the desquamation or "peeling" period, the latter stage being especially dangerous.

The contagion is transported by personal contact, by means of third persons, as physicians, attendants and members of the family, and also by means of clothing, bedding, furniture, room, etc. The contagion may also be carried through the air for some considerable distance and preserve its vitality for long periods of time. Its power of withstanding the influence of drying is remarkable, as the virus of the disease has been known to retain its vitality for months and even years in the dried scales.

Scarlet fever may also be conveyed by means of milk supplies, as has been shown in a considerable number of outbreaks. Generally infection of the milk has occurred through the presence of the disease in the household of the milkman,

METHODS OF PREVENTING THE SPREAD OF CONTAGIA.

(1) The patient should be isolated in rooms provided with as few furnishings as possible, where only the attendant and physician have access. Quarantine should be continued until desquamation or "peeling" is complete. This period is from two to four weeks, and may be even longer.

(2) Hot baths and oiling of the skin with an antiseptic oil or ointment every day or two are recommended during the period of desquamation to prevent the escape of dried particles of epidermis into the air.

(3) After recovery or death, the disinfection of clothing, room, furniture, etc., should be very carefully performed on account of the great powers of resistance possessed by the virus.

(4) Hospitals for convalescents are strongly recommended.

MEASLES.

W. D. FROST.

Measles, or rubeola, is an acute contagious disease, characterized by an initial cold in the head and an eruption on the skin of red papules that ultimately coalesce into blotches.

It is one of the most contagious of the eruptive diseases of childhood. It is endemic in all parts of the civilized world and occasionally breaks out in epidemic form. The mortality is usually slight except in severe epidemics which sometimes occur in tenement houses and in the army. When introduced among savages on native soil the mortality sometimes becomes extremely high, as for instance, in the Fiji Islands, where it was established in 1877. Here nearly one-fourth of the population died in a comparatively short time ("black measles").

The disease usually attacks children under eight years of age, although all ages are susceptible; adults more so than to scarlet fever. It is a disease of late autumn and early spring. Immunity is generally conferred by the first attack.

The exciting cause of the disease is supposed to be one of the bacteria, but the particular organism has never been found.

The period of incubation is 10 to 14 days, rarely 20.

The complications of measles are generally diseases of the respiratory tract, such as bronchitis, consumption and pneumonia, and when death occurs it is seldom due to the disease directly, but rather to some of its complications.

The contagium is contained in the secretions of the catarrhal surfaces and exfoliated epidermis. It is known to possess less vitality than the contagia of scarlet fever.

As a means of preventing its spread, the patient should be isolated and visited only by attendant and physicians, and all articles of clothing, dishes, etc., should be disinfected before they are taken from the sick room. After recovery the room should be carefully disinfected.

MUMPS.

W. D. FROST.

Mumps or parotitis is an acute infectious disease, characterized by a swelling of the salivary glands.

It is a disease native to all climates. It occurs most frequently in the fall and spring months. It is distinctly a disease of childhood, rarely occurring in children under one year of age and still less frequently among adults. Persons between the ages of 5 and 15 years are the most susceptible. It is slightly more common among boys than girls. The period of incubation is from 14 to 25 days.

A number of bacteria have been suggested as the exciting cause of the disease, but more evidence is needed to prove the causal relation of any to the disease. The disease is contagious from the last few days of the period of incubation to the subsidence of the attack, especially so during the period of active inflammation of the salivary glands.

The contagia are probably spread through the breath and secretions of the mouth; third persons and infected articles are unimportant agents. The method of prevention consists almost entirely in isolation, which should be continued for about three weeks.

BACTERIA IN MILK.

H. L. RUSSELL.

While milk is by nature well adapted to the development of human beings, it is also pre-eminently suited to the nourishment of the lowest of vegetable forms, the bacteria. As it is secreted in the milk glands of any healthy animal, it is free from all kinds of microbes, but even before it comes in contact with the air, bacteria begin to find their way into it from the milk duct. The conditions under which cows' milk is produced are such that germ life of various sorts readily find their way therein, and in the warm fluid multiply rapidly. The result is that unless special precautions are taken, milk will contain at any time before it is consumed, hundreds of thousands, and often millions of bacteria in every teaspoonful.

The manner in which this germ life finds its way into milk varies in different cases, and is conditioned largely by dirty or careless methods of milking or handling. A potent source of trouble is the dust and dirt that accumulates on the surface of the animal's body. The hairy coat offers exceptional facilities for the harboring of bacterial life, so that every hair that is dislodged and falls into the milk carries with it more or less of germ life, which at once begins to develop in the same. The movements of the animal during milking dislodge thousands of dust particles which find their way into the open milk pail. To a considerable extent the bacteria from such sources are originally derived from the intestinal content sof the animal as the coat of the cow becomes more or less covered with such filth.

EFFECT OF BACTERIA ON MILK.

Under ordinary conditions milk inevitably sours. This change which is really the production of acid from the sugar present in the milk, is so common an occurrence that its absence

immediately excites our attention and ordinarily leads to the conviction that such milk has been "doctored." The cause of this souring change is not due to the influence of thunderstorms or electric discharges, as is frequently supposed, but is attributable to the development of these minute organisms that naturally find their way into the milk. Various kinds enter with the dirt and dust and immediately begin to grow, causing the peculiar changes or fermentation that they are capable of producing. Normally the sour milk bacteria are most abundant, but at times milk turns "ropy" or "stringy," or becomes bitter or rancid, conditions which are produced by other kinds of bacteria that for the time being gain the ascendency over the more common acid-producing forms.

If all bacteria were kept out of milk these changes would not occur, and just to the extent to which they are prevented from finding their way into milk, just to that extent is the quality of such milk improved. The effect of clean milking and careful handling is seen at once in the better keeping quality of this liquid. Milk that is handled in the best possible way may thus be kept sweet for 24 to 48 hours longer by following such simple precautions as the following:—

Steaming the cans, bottles and pails to kill out adherent bacteria, moistening the hairy coat of the udder to prevent dislodgment of dust and adherent germ life during milking, taking care in the feeding of dusty feed immediately before milking.

To secure best results, cleanliness must be coupled with storage of milk at a low temperature. If milk is immediately chilled after it is drawn from the animal the temperature of the same is reduced, so that the few bacteria that ordinarily find their way into the same, even under most careful milking conditions, are retarded in their rate of growth. The relation of bacterial growth to temperature is shown in Fig. 14.

While milk usually contains a much larger number of bacteria than any other substance that is used as food, it must not be thought that all of these bacteria are positively harmful. By far the larger majority of them are concerned in the ordinary

souring changes, and while, of course, milk so fermented is unfit to drink, still even such bacteria have their uses; for, were it not for their presence in milk, the peculiar aroma and flavor that are to be noted in fresh butter would not exist. In the ripening of cream, preparatory to churning the same, fermentations are produced that give to such butter its pleasant taste.

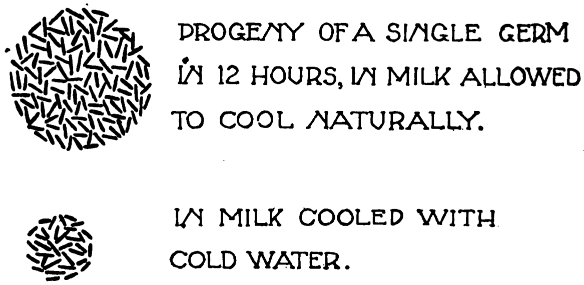

FIG. 14.—Relative rate of growth of bacteria at different temperatures.

RELATION OF DISEASE BACTERIA TO MILK.

Some of these bacteria that are associated with filth and dirt are able to cause trouble when taken into the susceptible intestinal tract of young children. It is a well known fact that the mortality of infants that are bottle-fed is very much higher than those that nurse. The reason for this is that bacteria of various kinds are introduced into the digestive organs by means of the food (principally the milk), and in this way summer complaint and infantile diarrhoeas are produced. During the hot weather when it is so difficult to keep milk, i. e., to prevent bacterial fermentation, these diseases occur much more frequently, and consequently the death rate from the same is correspondingly high in the heated season.

In all probability there are a number of different kinds of bacteria that are able to cause disturbances of this character in children, but almost all of them find their way into milk after it is drawn from the cow. The remedy for this trouble is (1) to keep these organisms out of milk by taking greater care in the *handling* of the product, or (2) to destroy them, if possible,

after they have gained access to the same, a condition that can be secured through the processes of pasteurization and sterilization.

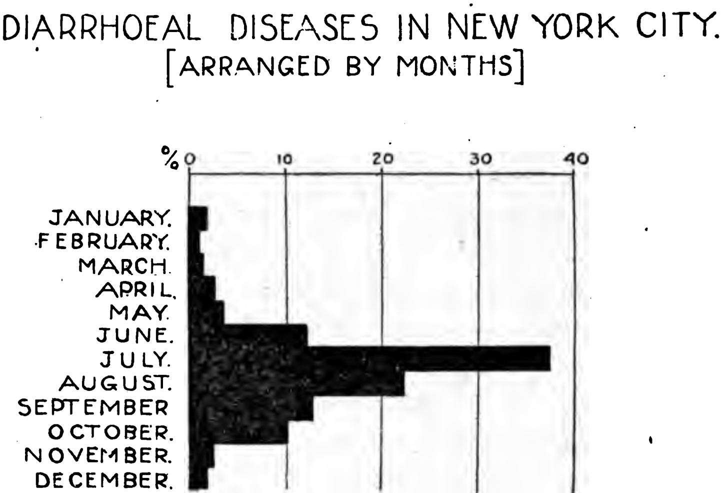

FIG. 15.—Seasonal distribution of diarrhoeal diseases showing how temperature conditions favor bacterial changes in food supplies.

In addition to the above, milk also may serve as a carrier of contagion through its infection with the germs of typhoid fever, scarlet fever, diphtheria, and tuberculosis. Disease bacteria of these sorts find their way into milk in two ways:

1. The first three mentioned diseases do not naturally occur in the animal; hence, it is impossible for contamination to take place while the milk is in the udder. The specific virus of each disease, however, develops well in milk, and consequently, if it happens that milk may become infected, after it is drawn from the cow, then growth of the disease organism is possible.

2. Tuberculosis, on the other hand, is a disease common to both man and beast, and at times the udder of the cow becomes affected so that the milk when drawn actually contains the tubercle bacillus which has been derived directly from the animal. Such milk is undoubtedly dangerous and liable to provoke the intestinal form of tuberculosis.

It may seem that the infection of milk after it is drawn, as in the case of typhoid fever, is very unlikely to occur, but as a matter of fact, a large number of epidemics of the diseases mentioned in the first class have been traced to polluted milk supplies.

Disease organisms find their way into milk in a variety of ways. With reference to typhoid fever, the following methods of transmission have already been determined.

1. Infection from washing cans with polluted water. A most striking case of this method of infection occurred at Stamford, Conn., in 1895. A very severe epidemic broke out and in the course of six weeks nearly 400 cases of typhoid occurred, 90% of which were patrons of a single milk dealer. A careful examination of the surroundings of the dairy showed that his methods of handling the milk were apparently satisfactory. An examination of the well from which water was taken to rinse the cans showed that the same was polluted with surface drainage, and from the surroundings, there was no doubt but that infection had been derived directly from near-by vaults. The fact that the cans had been rinsed in *cold* well water instead of scalding water sufficed to infect the milk and so distribute the contagion.

2. Even a more common method of infection than this is where the milk is contaminated either directly or indirectly by a person suffering from the disease. This is particularly apt to occur in scarlet fever and diphtheria, for in the case of these two diseases, the contagious matter is disseminated through the air. Persons convalescing from any of these diseases should under no consideration be allowed to assist in any way in milking or handling the milk after it is drawn, or even cleaning the cans and other utensils that will later come in contact with the milk.

Not infrequently an attendant, acting in the dual capacity of nurse and helper in the dairy, may serve as the vehicle of transmission of contagious matter.

With reference to the diseases that normally occur in the cow

that are also common to man, tuberculosis is by far the most important and practically the only one to consider here. The practical identity of the organisms of this disease in both cattle and man is now no longer questioned. While it is the greatest scourge in man, it is also a more or less common disease in cattle; but as in man, the lungs are preëminently the most susceptible organs, and it may often happen that the disease is confined to this and related lymph glands. Just how often the udder is affected is difficult to tell from data now at hand; but there is no reason to believe that this condition occurs in more than a few per cent. of all cases of the disease. Where this organ is affected (and this condition can generally be recognized by the slow formation of a hard, painless swelling), the milk undoubtedly contains the seeds of the disease, even though it may appear perfectly normal to the eye. Just what per cent. of tuberculous animals, not having udder lesions, possess infectious milk is yet a disputed question; but in any event prudence dictates that the milk of animals that possess the disease, even in the incipient stages, should not be used as human food, unless it has first been treated in a way so as to destroy any possible seeds of disease that may be present.

Since the introduction of the tuberculin test as an aid in the diagnosis of the disease, it has been possible to detect the disease in a great many animals that have the malady in the very earliest, and also, in a latent form, where no physical symptoms are apparent. Many such animals, while potentially dangerous in herds on account of the gradual development of the disease, may be used with perfect safety for beef purposes; because as a rule, the disease in these cases is restricted to organs not used as food. Moreover, as meat is consumed in a cooked condition it offers less danger than milk which is used in a raw state.

PREVENTION OF DISEASE TRACEABLE TO IMPURE OR INFECTED MILK.

It is easily possible to prevent milk from acquiring bacteria of disease that find in this food a good growth medium, but which do not develop in the living animal. If one secures the milk in the condition in which it is made in the udder, and keeps it from subsequent infection, the only danger that remains is in the possibility of securing milk from cows affected with tuberculosis. If the tuberculin test is used in dairy herds, and no animal supplying milk allowed to remain in such herds if they respond to this test, then the danger of tuberculosis can be absolutely and entirely eliminated. This is now being done voluntarily in many city supplies; and in some cases municipal ordinances compel all dairymen selling milk and cream to vend only the product from tested animals. Public sentiment is surely destined to grow in this direction, and this practice should be encouraged as much as possible.

BOOKS FOR REFERENCE AND PERIODICAL LITERATURE.

To supplement the text here presented, the following list is appended of the literature in book and periodical form that may aid the teacher in obtaining a more complete knowledge of the subjects considered.

REFERENCE BOOKS.

The following list is selected from a large and increasing number of books that are being issued on this subject. Any of these, and especially Nos. 1—6, are recommended as desirable additions to the school libraries:

(1.) Abbott, A. C. The Hygiene of Transmissible Diseases: Their Causation, Modes of Dissemination, and Methods of Prevention. W. B. Saunders & Co., Philadelphia, Pa. 1899. Price, $2.00.

This work is especially valuable as supplementing the text of this Bulletin, treating as it does the hygienic aspect of all of the important communicable diseases.

(2.) Conn, H. W. The Story of Germ Life. D. Appleton & Co., New York. 1897. Price, 40 cents.

(3.) Prudden, T. M. a) The Story of Bacteria.

(4.) ——— b) Dust and its Dangers.

(5.) ——— c) Drinking Water and Ice Supplies.

G. P. Putnam's Sons, New York. Price, 75 cents each.

(6.) Frankland, P. F. Our Secret Friends and Foes. Society for Promoting Christian Knowledge. (Romance of Science Series.) New York. 1891. Price, $1.00.

The above five books treat the subject of bacteria and their relations to man in a popular way and are excellent as elementary works.

(7.) Woodhead, G. Sims. Bacteria and their Products. Scribner's Sons, New York. 1891. (Contemporary Science Series.) Price, $1.25.

(8.) Newman, George. Bacteria, especially as they are related to the Economy of Nature, to the Industrial Processes, and to Public Health. G. P. Putnam's Sons, New York. (Science Series.) Price, $2.00.

(9.) MacFarland, Joseph A. Text-book upon the Pathogenic Bacteria. W. B. Saunders & Co., Philadelphia. Price, $3.25.

(10.) Russell, H. L. Outlines of Dairy Bacteriology. Madison, Wis. Price, $1.00.

The last four books are somewhat more comprehensive in their treatment of the phase of bacteriology considered.

PERIODICAL LITERATURE.

The magazine literature of the day often contains material that is more or less valuable for study. The appended list embraces the more important papers that have appeared in the popular and non-technical magiznes from 1895 to 1900. Many of them may doubtless be found in the files of the public libraries of most of the cities of the state. A number of subjects other than those specifically treated in the bulletin are included. The abbreviations of the magazines referred to are those usually employed in library references and hardly need any explanation. The volume number is given first, followed by a colon, then the page.

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1895. Priestly, Eliza. Penalties of Ignorance. 19th Cent., 37:579.
Steeves, G. Walter. An Anomaly in our Sanitation. Westmin., 143:667.
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Robinson, Louis. Science of Change of Air. Nat. Rev., 27:663.
Schofield, Alfred. Modern Hygiene in Practice. Ecl. Mag. 126:681 & 127:242.
Sedgwick, W. T. Notable Sanitary Experiments in Massachusetts. Forum, 20:747.
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Fall, Delos. Sanitary Science Teaching in Schools. Educ., 17:266.
Talbot, Marion. Sanitation and Sociology. Am. Jour. Sociol., 2:74.
Ward, M. E. Disinfection and Quarantine. Pop. Sci. Mo., 50:344.
1898. Editorial on Microbiology as applied to Hygiene. Nature, 58:15.
1899. Davison, Capt. L. B. Sanitary Work in Porto Rico. Independ., 51:2128.
Gerhard, W. P. Sanitation of Theatres. Pop. Sci. Mo., 56:84.
Hathaway, W. E. Hygiene for Pupils. Outlook, 61:924.
Hill, G. Everett. The Sanitary Condition of Havana. Forum, 26:529.
Wyman, Walter. Quarantine and Sanitation. Forum, 26:684.

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1895. Capitan, M. L. Microbes as Factors in Society. Pop. Sci. Mo., 47:103.
Edson, Cyrus. Microbe as a Social Leveler. No. Am. Rev., 161:421.
Smith, E. F. Action of Light on Bacteria. Am. Nat., 29:671.
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Sternberg, George M. Practical Results of Bacteriological Researches. Pop. Sci. Mo., 48:735.
1897. Aikman, C. M. Nitragin. Contemp. Rev., 70:210.
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Woodhead, G. Sims. Lecture on Bacteriology. Nature, 55:517.
1898. Aikman, C. M. Microbes in Agriculture. Ecl. Mag., 131:204, & 19th Cent., 43:994.
1899. Gabbett, H. S. Beneficent Germs. 19th Cent., 45:938.

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1897. Ethelmer, Ellis. Contagious Disease Acts. Westmin., 147:447.
1898. Frankland, G. C. Toxity of Eel Serum. Nature, 58:369.
Kinyoun, J. J. Antitoxins in the Prevention and Treatment of Disease. Forum, 27:717.
1899. Priestly, Eliza. Winged Carriers of Disease. 19th Cent., 45:671.
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Martin, Sidney. Royal Commission on Tuberculosis. Sci. Prog., 3:335.
1897. Long, James. Consumption in Cattle Conveyable to Man. 19th Cent., 42:581.
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Woodhead, G. Sims. Antitoxic Serum Treatment of Diphtheria. Nature, 51:402 & 425.
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Ferguson, John. Plague in India. Canada. Mag., 8:525.
Lubbock, Montagu. The Plague. 19th Cent., 41:184.
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Lloyd, Walter. Sanitation and Smallpox. Westmin., 150:548.

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HYGIENE OF THE EYE.

The eye is one of the most delicate organs of the human body. Its importance as the special organ of the sense of sight must always be borne in mind by teachers and school authorities.

Defects of the eye such as long-sightedness, short-sightedness, astigmatism, weakness, are many times the result of heredity, although they may be acquired through unhygienic conditions of the home or school and through habits of daily life which tend to aggravate existing defects or to promote a predisposition toward ocular disease.

The symptoms which accompany the defective eye-sight of school children are not well known to teachers. The latter are sometimes very tardy in recognizing defective eye-sight as a possible explanation of indolence and indifference on the part of the child. Headache, drowsiness, lack of interest in school work and apparent stupidity are among the symptoms which are characteristic of children having defective eyes. Many pupils have been reprimanded by their teachers for indifference when physical defects were responsible for their actions. The teacher should bear this fact in mind and carefully investigate the condition of the child's eyes before passing final judgment as to his conduct.

CAUSES OF DEFECTIVE EYES AND THEIR REMEDIES.

1. *The impaired general health of the pupil.*—Whatever affects the general health of the child has its influence upon the nervous system of the body and consequently contributes to the health or disease of the delicate nervous organism of the eye. The first general remedy to be applied is to carefully foster the general health of the pupil, and environ him with pure air, good

light, supply him with wholesome food, see that he takes sufficient out-door exercise, and is allowed plenty of sleep. The school room is no place for the weakling, and the tendency in our cities seems to be toward requiring a certificate of good health from a reputable physician as one condition for attendance upon the public schools. In this connection it is well to caution parents against allowing their children to read while they are on the sick bed or convalescing. The nervous tone of the body is then so low that any extra strain upon the optic nerve and its branches may result in permanent injury to the eyes.

2. *Badly constructed school desks and seats.*—Most school desks and seats are made from general models, without any reference to the peculiarities of individual anatomy. If the desk is too low and the seat too high, the child is compelled to stoop over, which causes his abdominal organs to be compressed, thus preventing the proper circulation of the blood through the eyes and other organs of the body. Heretofore the common practice has been to make a seat, place it in the school and compel the pupil to adjust himself to it. Thanks be to advancing ideas, however, for the adjustable school desk is now rapidly displacing the old form. The idea of the adjustable desk is to fit the desk to the child and not the child to the desk. It should be the only seat to be placed in any schoolhouse in the future. Where adjustable desks are not in use and cannot be obtained the following suggestions may be found of assistance:

Seats should permit each scholar to squarely rest his feet upon the floor, thus favoring a natural and upright position; for this purpose, it will be necessary to provide seats of different sizes for individual pupils, who should be seated according to their height. The seats should have comfortable backs; the desks must correspond in size to the seats and have slightly slanting tops; they should be far enough from the head of the scholar (when sitting in an upright position) not to necessitate close approximation of the page of the book. Many seats and

desks are so ill constructed for the needs of the individual student, as to just allow the head of the scholar to emerge from the top of the desk, thus necessitating enormous strain upon the eyes when attempting to study. For the assistance of school officials who may have the placing of seats, the following table is given. These figures are for permanent model desks. For adjustable desks the figures are generally trustworthy, though the teacher should see that each such desk is adjusted to the proportions of each child, and readjusted when any change of seating is made.

Single desks for one pupil.

Sizes.	Length.	Height of seat.	Height of desk top.	Floor space occupied.	Width of top.	Age of pupil seated.
No. 1	24	17½	30	30	15½	Adults.
No. 2	24	16½	29	28	15½	18 to 21
No. 2½	22½	16	27½	27	15½	15 to 18
No. 3	21	15½	26	26	13½	13 to 15
No. 4	21	14½	25	25	13½	11 to 13
No. 4½	19½	13¾	24	24	13½	9 to 11
No. 5	18	13	22¾	24	12½	7 to 9
No. 6	18	12	21¼	22	12½	5 to 7

Double desks for two pupils.

Sizes.	Length.	Height of seat.	Height of desk top.	Floor space occupied.	Width of top.	Age of pupil seated.
No. 1	40	17½	30	30	15½	Adults.
No. 2	40	16½	29	28	15½	18 to 21
No. 2½	40	16	27½	27	15½	15 to 18
No. 3	38	15½	26	26	13½	13 to 15
No. 4	38	14½	25	25	13½	11 to 13
No. 4½	38	13¾	24	24	13½	9 to 11
No. 5	36	13	22¾	24	12½	7 to 9
No. 6	36	12	21¼	22	12½	5 to 7

3. *Bad light.*—Lack of sufficient light causes the pupil to *strain* his eyes in order to read. The most remote portion of

the school-room should be bright, even on dark days. From his seat every scholar should be able to see some portion of the sky. The total window surface should bear to the area of the floor a proportion of one to five. The panes should be as large as possible. Cross lights if bright and glaring confuse the eye and should be avoided. Light should be direct and not reflected; it should come from the left and as high above the pupil as the ceiling will permit. Avoid the direct rays of the sun upon the page which is being read.

4. *Blackboard not properly placed with reference to distance and location.*—Sometimes the teacher is at fault in placing too fine writing upon the blackboard for the children to copy. This is a serious error and must be avoided by the teacher. There is no excuse for compelling children to read small writing on a blackboard clear across the room. Whenever blackboard copying is necessary, see that the children are brought close enough to the same so that no strain of the eyes is necessary. Avoid a position where the rays of light will be so reflected from the blackboard as to obscure the characters thereon. The less copying from the blackboard the better for the eyes.

5. *The following suggestions will aid in preserving the normal condition of the eyes:*

(a) Avoid the use of stimulants and drugs which affect the nervous system.

(b) Do not read while lying down—the habit of reading after going to bed is especially injurious.

(c) At least 25 per cent. of our school children have defective eyes. Glasses will many times remedy these defects.

(d) Avoid all forms of quacks. The eyesight is too precious a factor in life to risk in the care of any but the most learned and experienced.

THE HYGIENE OF THE EAR.

While the defects of the ear are not so prevalent among children as those of the eye, it is nevertheless the duty of the parent and the teacher to carefully observe the working and condition of these organs.

Many children suffer from nasal obstructions and particularly from enlargement and engorgement of the tissues in the upper part of the pharynx and throat. Such obstructions prevent free nasal breathing and compel the use of the mouth for this purpose, besides giving rise to deafness, on account of the lack of proper aeration of the middle ear through the Eustachian tube leading from the upper portion of the throat to the ear. These enlargements in the pharynx, called "adenoid growths or vegetations," are productive of a large majority of chronic ear diseases from which children suffer. Fortunately they may be easily removed, and some of the most satisfactory surgical results ever witnessed follow such operations. These children, called "mouth breathers," present a peculiarly dull and stupid appearance which is aggravated by the almost invariably accompanying deafness. Removal of the growths and the proper treatment of the ears completely revolutionize the appearance and character of the child, and if one has ever observed such physical and mental transformations, he will never forget them, nor fail to emphasize the importance of such work.

INSTRUCTIONS TO TEACHERS.

The question that naturally arises in the teacher's mind is, what can I do to remedy the defects in the children's eyes and ears? Various plans have been adopted in many cities of the United States. In St. Paul, Minneapolis, Worcester, Mass., Sycamore, Ill., Philadelphia, Chicago, and San Francisco, a

systematic method for the examination of pupils' eyes and ears by teachers has been in use for some years. Simple questions and instructions enable the teacher to detect the presence of the more characteristic eye and ear diseases. Reports from these cities indicate that much goood has come from this system of examination.

While the best plan would be to have such examination conducted by a specialist, it is possible for the intelligent teacher to carry on an investigation and roughly ascertain any material defects in the eyes and ears of his children. The following blank will indicate the method of examination in the Milwaukee public schools. It is self explanatory and is recommended for use in the schools of Wisconsin. The blank can be very easily reproduced for smaller schools as no great number will be needed.

Room.......... School..........

PUBLIC SCHOOLS.

Teacher........ Principal........

Eye and Ear Examinations.

Date, ...190

Entire number of pupils enrolled:	
Males	....
Females	....
Total	....
Average age	....
Number found defective and advised to consult an occulist or aurist:	
Males	....
Females	....
Total	....

Instructions For Eye Examinations.

First grade children need not be examined.

The examination should be made privately and singly in a room apart from the general school session.

Ascertain if the pupil habitually suffers from inflamed lids or eyes, or if the eyes grow tired or if headaches commonly occur after study. Ascertain if the pupils' eyes seem "straight."

For the examination of the visual acuity, children already wearing glasses should be examined with them properly adjusted on the face.

Place a card of Snellen's test types on the wall in good light, the center of the card being about level with the pupil's eyes. This is *not* to be covered with glass. Do not expose the card except when in use, as familiarity with its face leads children to learn the letters by heart.

The line marked XX (20) should be seen at 20 feet, therefore, place the pupil 20 feet from the card.

Each eye should be examined separately.

Hold a card over one eye while the other is being examined. Do not press upon the covered eye, as such might induce an incorrect examination. The pupil should keep both eyes open.

Have the pupil begin at the top of the test card and read aloud down as far as he can, first with the right eye and then with the left.

If the pupil does not habitually suffer from inflamed lids or eyes, if the eyes be straight, and if he can read a **MAJORITY** of the XX (20) test types with each eye, and does not, upon inquiry, complain of *habitually* tired and painful eyes and headache after study, his eyes may be considered satisfactory and his name should *not* be entered upon this sheet.

But if he habitually suffers from inflamed lids or eyes, if the eyes are not "straight," or he cannot read a **MAJORITY** of the XX (20) test types with BOTH eyes, or *habitually* complains of tired and painful eyes or headache after study, his name and detailed report of the examination should be entered below on this sheet by the teacher and a card of information sent by the principal to the parent or guardian.

Instructions For Ear Examinations.

In a room apart from the general school session examine the pupils singly, ascertaining if the pupil complains of earache in either ear, if matter (pus) or a foul odor proceeds from either ear, if the pupil fails to breathe freely through either nostril or if he breathe mostly through his mouth. Have the child turn his back, an assistant plugging up the left ear with a cloth over his finger. The examiner steps away about 20 feet, asks the child a direct question in a low voice, requiring a direct answer. The right ear is then to be stopped and the left tested. If after several questions the child fails to hear the spoken words and answers incorrectly he is deemed defective. A good sized watch is held about six feet away and gradually moved towards the ear to be tested and distance at which the subject says he hears the tick is noted. It should be heard at least three feet away from the ear. If the pupil fails to hear spoken words or the tick of the watch as above noted, if he complains of earache, if pus or a foul odor is observed from either ear, if his nose is habitually stopped or if he is a mouth breather, his name and a detailed report should be entered below on this sheet by the teacher and a card of information sent by the principal to the parent or guardian.

SCHOOL........ ....
EXAMINER ....

PUBLIC SCHOOLS.

ROOM....................
PRINCIPAL..............

EYE AND EAR EXAMINATIONS.

No.	NAME.	Sex.	Age.	EYE.					EAR.						
				Does the pupil habitually suffer from inflamed lids or eyes.	State number of last line of test types seen by pupil with right eye.	State number of last line of test types seen by pupil with left eye.	Do the eyes and head habitually grow weary and painful after study?	Is the pupil probably "cross-eyed?"	Does the pupil complain of earache?	Does pus or foul odor proceed from either ear?	Does the pupil fail to hear ordinary voice at 20 feet?	Does the pupil fail to hear tick of ordinary watch at 3 feet with either ear?	Is the nose habitually stopped or the pupil a mouth-breather?	Did the pupil consult an eye or ear doctor and follow advice? If not why?	Briefly describe results of treatment in this case and at foot of column write your opinion as to efficacy of these examinations in your school.

Examine your entire class by these methods, at the beginning of the school year, part of the pupils each day, so as not to interfere with the regular course of instruction. Examine each pupil entering between beginning and end of terms. Only such pupils as are thought necessary to send to an eye or ear physician need tabulation on this blank. This sheet is to be filled in duplicate and, at the completion of the examination of your school, both copies are to be given to your principal, who will immediately send one to the Commissioner of Health. At the end of the school year the principal will send the duplicate copy to the Commissioner of Health, after noting in the last two columns of the blank, whether the pupil has consulted a physician, or, if not, why, and describe the results of treatment, particularly as regards the pupil's conduct, health and application to study. At the same time the principal will submit to the Superintendent of Schools a written report on the medical examinations made in the school in the year, giving the number of boys and the number of girls examined in addition to the information contained in the report to the Commissioner of Health at the end of the year.

The following form of a blank may be used in giving notice to parents of any defects found by the examination:

Warning Card to Parents.

.............., Wis., ..., 190....

Dear Sir:

After due consideration, it is believed that your child has some Eye..........Ear* disease for which an Eye..........Ear* Doctor of recognized standing should be consulted.

It is earnestly requested that this matter be not neglected, as children with Eye..........Ear* diseases cannot attain the best results in school.

Respectfully,

....

Principal .... School.

The ophthalmic chart alluded to can be obtained of Almer Coe, Optician, 65 State St., Chicago, Ill., at a cost of 25 cents.

Dr. Wurdemann, of Milwaukee, in a recent address to the principals of the Milwaukee public schools said:

"One important matter should be remembered in these tests, viz.: they are not conducted solely for the purpose of detecting ocular

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*Either the word "Eye" or "Ear" may here be crossed out, as may be appropriate for the case. If the pupil has presumably Both imperfect Eyes and Ears, both words may be left, and the space between the words "Eye" and "Ear" should be filled with the word "and."

conditions requiring the use of glasses. Many seem to have the idea that they simply detect errors of refraction, but such is not the case, as they will, if properly carried out, detect the existence of almost all serious ocular diseases or conditions. Of course, the teacher does not know what disease is present, but that something is wrong; that is sufficient. The sole idea in the tests is to separate those children having good eyes and ears from the defectives. These tests should be made at the beginning of the school year, statistical reports prepared and reports of the defectives again made at the end of the school year. Those passing the tests successfully are returned to the school and not re-examined for one year, when they should undergo another examination, as morbid conditions may have developed meanwhile. Those having defective eyes and ears are simply given a card of warning, which they hand to the parent. This card merely states that some eye or ear disease is believed to exist, and the consulting of a physician, therefore, is advised. The matter is not compulsory, as the parent may do as he thinks best; he may consult any physician or dispensary he chooses. In this way the duty is thrown upon the shoulders of the parent, where it belongs; but if compliance with the advice is not observed, the teacher may from time to time urge the matter with tact and delicacy, but nothing should be said to make the parent regard the matter as an arbitrary demand."

The above method of examining the defective eyes and ears of pupils in the public schools cannot possibly meet objection by any reasonable teacher, parent, or physician. The teacher is not obliged to consume any of his regular time of instruction in this examination. A few pupils examined each night after school will be sufficient to ascertain the defects in any ordinary school within ten days. The teacher can then fill out and send to parents the blank indicated above, and the responsibility then rests with the parents. Whether they see fit to send the child to a reputable physician or not, is a matter which rests entirely with them.

That this system will remedy all the physical defects of the eyes and ears of children is not supposed for one moment, but it is thought that calling the attention of teachers, parents, and school officers to these matters may lead to a discovery of defects which might otherwise go unnoticed. It may also be a most helpful suggestion to teachers who have been wondering why a certain child did not do the best kind of work in school. The results of the investigation may also be more or less a revelation to parents, who, although they may have suspected that some-

thing was wrong with these special sense organs of the child, yet the fact may not have been impressed upon them until they receive notice from the teacher, as per the plan herein suggested.

SPINAL DISEASES.

The results of investigations made by medical experts indicate that a considerable number of school children are afflicted with spinal curvature, and it is very probable that the public schools to some extent are responsible for this phase of deformity in a few, if not in many pupils. To be convinced of this fact, one needs only to step in to any school room, especially during the writing period, and to note the various attitudes assumed by the individual pupils. In many cases, the feet will be found dangling in the air on account of the seats being too high; the arms may reach upward because the desk is too high for the pupil; the head is generally bent over and in many instances one shoulder will be thrown several inches above the other. These evils sooner or later must bring about a deformity in the pupil. The seat, if too high, will cause the long bones of his legs to become distorted on account of the flexible condition of the bones; the desk, if too high, will cause the shoulders to be thrown upward and "hunch-back" will result; one shoulder being thrown higher than the other must cause a curvature of the spine; while the bending over position crowds the shoulders together, limits the space for the expansion of the lungs, thus promoting diseases of these organs.

It does not need any medical expert to correct these evils. Careful attention by the teacher to the sitting and standing attitudes of pupils with some timely advice and the application of proper correctives will be sufficient to avoid deformities. What was said under "desks," in defects of the eyes, on p. 65 above,

is fully applicable to the conditions here noted. Teachers must ever be on the lookout to see that their pupils sit erect; that their feet are flat upon the floor, and that both shoulders are the same height. It is true that some school desks, especially in primary rooms, are so high that these conditions cannot be conformed to, yet if that be the case, the attention of the school authorities should be called to the conditions and every effort made to provide suitable desks for the growing children. In many instances, the teacher may be able, by changing the seating of the pupils, to give the larger pupils the larger desks, and the smaller ones the smaller desks. The stoop-shouldered, narrow chested, or crooked back pupil should have the careful attention of the teacher. His future physical well being is as important as his mental condition and the former many times determines the latter.

While the adjustable desk is the ideal one for the school, if it is never "adjusted," it is worthless. At the beginning of each school year the teacher should make careful measurements of each and every pupil under his charge and either adjust the seats and desks himself, or see that they are raised and lowered by the janitor or other person, according to measurements taken. Whenever during the year pupils are changed the seats should be readjusted.

HEATING AND VENTILATION.

One or two thermometers should be placed in every school room, preferably suspended from the ceiling, as it is not a fair test to place them either upon the cold outside wall, or in some remote corner where the heat can not reach them. Every school room should be kept at the temperature of from 65 to 75 degrees. It certainly should not be lower than 65 degrees, and it is just as important that it should not rise above 75 degrees. This rule, however, is too often violated by teachers. They keep the school room in such an overheated condition that the pupils become drowsy, and consequently can not do justice to their own abilities.

Of the effects of foul air, it is hardly necessary to speak. Every one knows that a disagreeable feeling accompanies the breathing of impure air. Stupor, inactivity, drowsiness, headache, and even nausea and fainting, result from the breathing of impure air. It is true that these sensations are easily thrown off on entering the pure air, the poisonous gas of the blood being displaced by the pure oxygen from the air. The belief with some, however, that the result of breathing impure air is merely temporary, is wrong. While the young and vigorous child may be able to throw off the temporary results of breathing impure air, yet every time the system is called upon to throw off an excess of carbonic dioxide gas and other impurities the sum total of its vitality is lessened. It is most apparent that persons confined indoors do not have the health and vigor of those who enjoy the fresh air through out-door work.

Modern ideas in connection with school architecture are responsible for great improvements in the heating and ventilating of later day school houses. All new and well constructed buildings are provided with conduits for the entrance of fresh air and the exit of foul air. While many buildings are thus pro-

vided with a good ventilating system, it is a fact that many teachers are perfectly ignorant of its working principles, or if they understand it they may pay no attention to the matter. Very frequently the foul air ventilator is found closed, or a chart or some other obstruction is placed in front of it. This leads to an accumulation of foul air in the room. A ventilating system is useless unless the teacher has a thorough acquaintance with its working and exercises eternal vigilance in regulating it. School boards and superintendents should hold teachers to a strict account for neglect to pay attention to these matters.

In the older buildings, where there is no system of ventilation, enabling fresh air to enter the school room, and providing an exit for foul air, some remedy must be adopted. Opening a window is sure to cause a draught on some of the pupils, resulting in colds, sore throats, and other troubles. But it is not a difficult matter to provide some form of ventilation in such buildings by means of the windows. The upper sash may be lowered and means provided for the air on entering to be thrown upward. In the same way, the lower sash may be raised and means provided for throwing the fresh air upward; this form of ventilation may be applied to several windows, if necessary, in one room, so that the change in the direction of the wind will not affect the ventilation.

It is surprising to know how little heed is paid to the subject of ventilation. This may be due to the fact that in new buildings the teachers think there is an automatic apparatus which does not need their attention; while in the old buildings the teachers are apt to think that only in the modern structure, is there any means of ventilation. They do not stop to think that they can very easily ventilate their own school rooms, if they will only make a little exertion to do so.

Instruction in Agriculture and Domestic Economy in Rural Communities in Wisconsin.

Wisconsin Dept. of public instruction

Transportation of Rural School Pupils at Public Expense.

BULLETIN OF INFORMATION NO. 5.

ISSUED BY
L. D. HARVEY,
State Superintendent.

MADISON
Democrat Printing Company, State Printer,
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AGRICULTURE AND DOMESTIC ECONOMY IN RURAL COMMUNITIES.

By L. D. HARVEY, STATE SUPERINTENDENT.

There has been for some time a steadily growing demand that provision should be made in the public schools for instruction in the principles of agriculture. This question has been discussed in farm journals, in farmers' institutes, at meetings of the National Congress of Farmers, and by writers in scientific, educational, and other journals. The Province of Ontario has this year provided for giving instruction in this subject in all the rural schools within its borders. In New York, work has been going on for two or three years, under the auspices of the agricultural department of Cornell University, directed toward securing intelligent and effective work in nature study in the public schools of the state. In other states, the subject has been agitated, but little has been attempted beyond the work of the agricultural colleges and experiment stations. This wide-spread interest in and discussion of the subject, should arrest the attention of those engaged in educational work, and especially all those who have to do with the determination of educational systems and policies.

The discussion concerning the incorporation of courses of study in domestic economy in our public schools, with special reference to the needs of the girls, has been confined almost entirely to the cities. There is a growing sentiment in this country in favor of making a place for that study in our public school courses. An examination of the field will disclose the fact that in manual training, in the specific work known under the head

of domestic economy, and in the work in agriculture thus far organized in this country, we are far behind foreign countries, both in the scope of the work attempted and in the extent to which it has been organized. France, Germany, Ireland, Belgium, Denmark, Norway and Sweden, have all made far greater progress than we in giving instruction in the principles of agriculture, in grades of schools below the agricultural college. Most of these countries have developed work in manual training in large numbers of schools, to an extent found in but few of the cities in this country. In several of those countries they have also made much progress in teaching domestic economy to pupils in the public schools. In view of the extent to which these lines of work have been carried in the countries of Europe, and of the agitation for their organization in the United States, the following questions arise:

First:—Is this new demand simply another fad, or does it grow out of a real necessity which is coming to be recognized by the people?

Second:—In the field of agriculture, is there any useful body of knowledge which can be taught outside the agricultural college, to farmers' boys, either in existing schools or in schools to be specially organized for such work?

Third:—Will this body of knowledge, if taught, and the training coming with the mastery of it, be of greater practical value to these people than any other body of knowledge and accompanying training which could be given during the same time? The same questions apply with equal force to the subject of domestic economy in the teaching and training of girls, in rural communities.

The foregoing questions will now be considered in order.

FIRST:—"IS THIS NEW DEMAND SIMPLY ANOTHER FAD, OR DOES IT GROW OUT OF A REAL NECESSITY WHICH IS COMING TO BE RECOGNIZED BY THE PEOPLE?"

In considering this question it is necessary first to consider how far existing school facilities in rural communities meet the needs of the young people being educated in those communities, and also to what extent the boys and girls living in the rural districts are availing themselves of the opportunities for education offered in the high schools and higher institutions in cities. The complaint is universal that the common schools in rural communities are not up to the standard which is desired. Those who know anything of the conditions in these schools believe this complaint to be well founded. This condition is due in part to the fact that the teachers in those schools have not had proper training, that their work is not properly supervised, and that the term of school is not of sufficient length. It is also due to other conditions incident to the scattered population, and the exigencies of farm life. These conditions are such as to make it impossible to give the kind of training and instruction in these schools which is needed to secure the best results. Does the common school in rural communities equip the boys and girls attending them as they should be equipped to successfully meet the conditions of rural life which exist today?

DEMANDS WHICH MODERN CONDITIONS MAKE UPON THE SUCCESSFUL FARMER.

The farmer feels the press of competition at the present time more than ever before in the history of this country. Facilities for transportation make it possible to lay down farm products grown at great distances from him, in his home market. Industrial organization in various lines is making itself felt upon the farm. The farmer of the future must be not only intelligent in his farm work, but he must be a business man as well. To farm successfully today, requires greater intelligence and business sagacity than ever before. In manufacturing it has come

to be recognized that technical training and skill based on scientific knowledge are absolutely essential for success in competitive fields. The same thing is true of farming. The farmer must know something of the scientific basis upon which successful results in agriculture depend. He must be able to read intelligently books and journals which present the results of the latest investigation, thought, and experience in his line of work. He must not only have the ability to do such reading, but he must know that it is a necessity for him to do it, and he must have a desire to do it. He must also know how to carry into his work on the farm, principles of business organization such as are required in any other field of industrial or commercial enterprise. He must know whether a given crop or stock product is costing him year by year more than it returns to him, and if so, he must understand what modifications it is necessary for him to make, in the carrying on of his farm, in order to prevent such loss. He should also be familiar with the principles of economics at least in so far as those principles in their application, affect him personally. He should also have such a further knowledge of economic conditions which may be affected by legislation, as will enable him to reach correct judgments, that may determine his action as a voter and as a citizen.

In order to secure the most desirable quality of citizenship, other things than these are also necessary. Some of these additional things the schools are now attempting, with more or less success, to give.

EDUCATIONAL CONDITIONS IN RURAL COMMUNITIES.

In Wisconsin last year, the total enrollment in the public schools was 429,794. Of this number, 306,574 were enrolled in the rural schools. In the city high schools there were enrolled 2,565 non-resident pupils. These may properly be regarded as pupils from rural communities who are attending high schools in the cities, leaving 306,574 enrolled in the country schools who get practically no further school training than that afforded by these schools. The greater number of these boys and girls will

continue to live in the country, although many of them will drift to the cities, some to achieve success, others to be lost in the whirl of city life.

Will any one contend for a moment that the instruction given in the rural schools will adequately equip these 306,574 boys and girls for the highest success, either on the farm or in the city? Remembering that these country schools are taught by teachers in many cases poorly prepared, and unaided by good supervision, considering the irregularity of attendance, and the length of the school year, could it be expected that the most desirable results would be secured? These pupils go out from the school with perhaps a better knowledge of arithmetic than of any other subject taught, and yet those who have had to do with them, know how meager their knowledge of this subject is, and how little skill they possess in applying this knowledge in practical business operations. They have learned a few facts of geography, most of which will be forgotten within a year after the close of school. Few of them have any adequate command of the English language, or know how to write a business letter. They have studied some text book in U. S. history, but have probably learned more of the details of battles and campaigns than of any other phase of the history. Of the commercial, industrial, and economic development of the country, they know little or nothing. They have committed to memory some portions of the constitution of the state and of the national government, but know little of civic life beyond this. Not one in ten of them can read a popular book on the principles of agriculture, or a farm journal intelligently. Of the sciences upon which successful practice in agricultural pursuits depends, they know absolutely nothing. And yet, they are to enter upon their life work with this preparation. I am not claiming that all this work can properly be done in the rural schools, nor that all of it can wisely be undertaken. With properly trained teachers it is possible that beginnings in the study of elementary science might be made in the rural schools, but few of the pupils have the maturity of mind to enable them to grasp anything beyond the merest rudiments of

these sciences until after their days of attendance at the rural schools have passed. In this discussion I am confining myself chiefly to the specific preparation for intelligent work in agriculture and in domestic economy, and shall not attempt to discuss the general lines of training now undertaken in the public schools. I am not now contending that the schools shall give all the information and training essential for the farmer's success. The schools can not do it if they would. A large part of this training and information must come from the boy's experience in the actual work of farm life. What I am contending for is that the schools at the present time and under present conditions of organization, do not furnish such knowledge and training as will enable the farmer's boy to make the most of himself upon the farm, and to derive the largest benefit from his contact with and experiences in the every day work of the farm. His interest in farm journals is confined chiefly to the illustrations and the advertisements. He does not care to read, and could not read intelligently if he would, much of the matter which would be of most value to him in these journals. The same is true of the large number of most excellent books now published dealing with the best modern practice in farming.

Thus far I have been dealing with the conditions under which the boy enters upon an active farm life. How is it with the girl? Her instruction in the rural school has been the same as that given the boy. Has it better fitted her for her duties in rural life than it has the boy? Whatever she has learned directly fitting her to discharge these duties, she has learned in the home and not at the school. I believe that she may better learn many things in the home than in the school. I know she does not learn many things in the home which she ought to know and practice in her own home later on, both for her own well being, comfort and happiness, and for that of her family; and I further know that many of these things may be taught in the school. Not all of them in the rural school, under existing conditions, but that a school may be so organized as to give knowledge and training in these essentials.

PRESENT AGITATION DUE TO A RECOGNIZED NEED FOR SOMETHING BETTER.

In view of these considerations does it not appear likely that the present agitation in favor of a more practical training of boys and girls in the rural communities, for the every day concerns of rural life, is the outcome of a careful consideration of these questions, of an agitation on the part of those who have considered them, which has resulted in an awakening of public sentiment, culminating in a demand for something different at least, from what we now have. With many people the demand is based upon dissatisfaction with present conditions; a demand for something, they know not what. They see that the rural schools are not doing for country boys and girls all that they need to have done for them, and while they are vague as to what more shall be done, and as to how, when, where, and by whom it shall be done, they are earnest in the desire that something shall be done. This demand, then, is not a fad; it has grown out of a settled conviction on the part of a large number of people that improvement is necessary, and they are looking to those whose business it is to study, shape, and organize educational systems and policies to show the way in which it can be done.

SECOND:—"IN THE FIELD OF AGRICULTURE AND DOMESTIC ECONOMY, IS THERE ANY USEFUL BODY OF KNOWLEDGE WHICH CAN BE TAUGHT OUTSIDE THE EXISTING AGRICULCULTURAL COLLEGE AND TECHNICAL SCHOOLS, TO FARMERS' BOYS AND GIRLS, EITHER IN EXISTING SCHOOLS, OR IN SCHOOLS TO BE SPECIALLY ORGANIZED FOR SUCH WORK?"

This is a question which most people will at once and without hesitation answer affirmatively, and yet it is not so easy to formulate the body of knowledge which can be so taught. The Province of Ontario, in Canada, answers this question by putting

into every rural school in the Province this year, a text book on Practical Agriculture, which is to be taught by the teachers of those schools. This book deals in Part I with *The Plant;* Part II, *The Soil;* Part III, *The Crops of the Field;* Part IV, *The Garden, Orchard, and Vineyard;* Part V, *Live Stock and Dairying;* Part VI, *Other Subjects,* which includes chapters on bees, birds, forestry, roads, and the rural home, and an appendix giving list of trees, list of weeds, spraying mixtures.

Cornell University has organized a bureau in its agricultural department which is this year expending $18,000 in an effort to secure an intelligent consideration of nature study in the common schools of New York. Prof. Bailey, who is at the head of this bureau, does not send out a formal course of study, but does seek to secure organized effort through farmers' bulletins, leaflets for farmers' reading clubs, and leaflets for the teachers which give in detail lessons in nature work, and which are to serve as a guide for the teachers in carrying on this subject in the school.

A number of the agricultural colleges of the country have organized short courses for the purpose of meeting the wants of the farmers' boys who have had no other education than that which the country schools afford. The short courses offered by the Agricultural Department of our own University are among the very best. In these short courses some very practical subjects are being considered, and that they are being considered with success is shown by the fact that the boys who take the work in the short courses are eagerly sought for to take positions at good wages. After even two short terms' work in these courses, the earning capacity of these boys, as measured by what farmers and dairymen are willing to pay for their services, is doubled or trebled.

It is unquestionably true that the school which is to best fit the boy or girl for farm life, and probably for any other kind of life, should undertake to train them to intelligently observe the things about them. It should not only train them to observe intelligently, but in the giving of that training it should

direct the observation so that it shall concern itself with what is worth observing, and so that the results of the observation will be not merely curious or interesting information, but knowledge which shall be of value. The study of nature to be of most value for the purposes under consideration, must go beyond mere observation of phenomena, and wherever it is possible, seek for the reasons lying back of the phenomena.

AGRICULTURAL INSTRUCTION PROVIDED FOR IN FOREIGN COUNTRIES.

In Ireland agriculture has been for years a compulsory subject for boys of the fourth and higher classes in all rural schools, and it is optional for girls. For this work the Commissioners of National Education have laid down a program consisting of various chapters of a book entitled "Introduction to Practical Farming," which deals with such subjects as the following: Cultivation of land; manures; live stock; dairying; gardening; agricultural implements; land drainage and reclaimation; farm fences; etc.

In France, instruction in "Elementary Ideas of Agriculture" is compulsory, and a complete scheme in the form of a practical guide for the uses of teachers for giving such instruction has been formulated. It states the aim as follows: "The aim of elementary instruction in agriculture is to initiate the bulk of our country children into that degree of elementary knowledge which is necessary to enable them to read a modern book on agriculture with profit, or to derive advantage from attending an agricultural conference; to inspire them with a love of country life, so that they may prefer it to that of towns and factories; and to convince them of the fact that agriculture, besides being the most independent of all means of livelihood, is also more remunerative than many other occupations, to those who practice it with industry, intelligence and enlightenment."

A former Director General of French agriculture, in speaking of agricultural instruction, says: "The aim and object of France has been not only to give to children and young people the means of acquiring knowledge, but also to establish means for interesting old cultivators. In this country of extreme

competition, we must admit that the agriculturist can only thrive if, in working the soil, he adopts scientific methods. Old routine is no longer sufficient in this branch, as it is proved to be insufficient in manufacture."

In Germany agricultural education has so broadened out as to include training in every technical part of a farmer's work, culture of forests, fruits, flowers and vines; schools to teach wine, cider, and beer making, machine repairing, engine running, barn construction, and surveying; knowledge of poultry, bees, and silk-worm raising; domestic economy, sewing and accounts for farm women.

The royal commission appointed to investigate the causes of agricultural depression in England, in 1897, reported among other things, as follows: "We believe that it is essential for the welfare of agriculture that there should be placed within the reach of every young farmer a sound, general school education, including such a grounding in the elements of sciences bearing upon agriculture, e. g., chemistry, geology, botany, and animal physiology, as will give him an intelligent interest in them and familiarize him with their language."

In the Scandinavian countries of Norway, Sweden, Denmark, and Finland, agricultural education has reached a high stage of development. There are more than 150 agricultural, horticultural, forestry, and dairy schools in these four small states. Agricultural instruction in these states is not undertaken in the primary schools, but is offered in a class of schools corresponding somewhat to our high schools, taking as students young men who have reached 18 years of age, and who wish to fit themselves for the work of farming.

Nearly every other country of Europe, including Russia, as well as many of the colonial dependencies of European nations, have organized schools for the purpose of instruction in this subject. In view of these facts, it would appear that there must be a considerable body of knowledge concerning the subject of agriculture, which the schools may undertake to teach.. In view of the status of agricultural instruction in France, Germany, Ireland, England, and the Scandinavian countries, it would seem

that there is such a body of knowledge pertaining to this subject as may properly be taught in the schools of a lower grade than the agricultural college.

WHAT MAY PROPERLY BE ATTEMPTED?

Without attempting to go into detail, it seems entirely reasonable to assume that instruction may be given profitably in schools of the grade of our elementary and secondary schools in the following subjects:

The Soil.
Plant Life.
Animal Life.
Economics of Agriculture.
Manual Training.
Domestic Economy.

In dealing with the first topic, *The Soil,* consideration should be given to its composition, modes of cultivation, fertilization, drainage, effect of rotation of crops upon the soil, means of restoring worn out soil to a condition of fertility, and the adaptation of different soils to different classes of products.

Under the second topic, *Plant Life*, there should be a consideration of the various forms of cultivated plants, including a knowledge of best varieties for local cultivation; germination; modes of growth; modes of harvesting; care for after harvesting; effect upon soils; economic values for marketing, for feeding, and for fertilization. For the boy who is to be a farmer, or the girl who is to be a farmer's wife, and possibly for any other boy and girl, the botany of the corn plants, the modes of growth of other forms of plant life on the farm, if properly taught, may prove at least of as much value as the study of mosses, or other forms of plant life upon which much time is now spent in the field of botanical instruction. This study would be for him a matter of practical utility, and would give him knowledge that would awaken an interest in the growth of agricultural products, resulting in more intelligent cultiva-

tion, better adaptation of crops to soil, and better financial returns.

Treatment of the third topic, *Animal Life,* should provide for a study of the domestic animals grown for pleasure or profit, including a knowledge of breeds and breeding; feeding; judging; care, including the prevention and treatment of the diseases of domestic animals; preparation for marketing either the animals or their products; and such knowledge of animal pests, and of the modes of treatment for the prevention of their ravages, thus far discovered, as would enable the farmer to save many a crop which otherwise might be ruined. Might not such knowledge be so organized and taught as to be of at least as great value, both for knowledge and for training, as the study of the tadpole, the crayfish, and the angle-worm?

In treating the fourth topic, *The Economics of Agriculture,* study should be made of the relations of the farmers to general industrial, and commercial organizations; of the economics of farm life, including a practical system of domestic accounting, whch would enable hm to tell with the same accuracy that the manufacturer tells, the cost of any given product during any given period of time.

Under the fifth topic, *Manual Training*, instruction could profitably be given in wood working, not only for the purposes of hand and eye training, but for the practical knowledge and skill resulting from such training, and which would be of value to him as a farmer. To this might be added elementary instruction in blacksmithing, which would enable him to make any of the simple repairs of tools at home, that otherwise he would be compelled to have done at a distance from his own home, and with considerable expenditure of time and money.

Under the general subject, *Domestic Economy,* instruction could be given in sewing, including dress making and millinery work, which certainly would be of value to the girls who are either to perform these lines of work for themselves, or to supervise that work when done for them by others. It would not only develop skill, but would cultivate the taste, and develop a

knowledge of the difficulties incident to such work which would make them more considerate of those who might be in their employ, or under their supervision.

In cooking, a course of instruction might properly be given which should include a knowledge of the constituent elements of food products, and their value for definite purposes, which would enable them to construct for the animal, man, a balanced ration. For all concerned this is perhaps as important as the determination of a balanced ration for the cow or the hog. It should also include a knowledge of invalid cooking, which would enable them to know what are proper foods for invalids and how to prepare such food. Such a course of training would develop economy and skill in the choice and preparation of food which would not only result in the saving of money, but in the better physical, mental, and moral condition of those fed. To this might be added practical instruction in the different details of housekeeping which would add much to the appearance, pleasure, and comfort of the home.

In horticulture and floriculture, instruction might be given which would be of value to both girls and boys in the matter of adornment and beautifying of the home surroundings.

For the work on the soil, on plant life, and animal life, and in cooking, a knowledge of essential scientific principles and their application would be necessary. It would not be necessary, even though it were desirable, to give extended courses in geology, botany, zoology, physics, and chemistry in order to place this instruction on a rational, scientific basis. For the teacher, it would be essential that he decide what is to be taught in any one of these branches, and then to decide what knowledge of science is necessary in order that the desired instruction may be properly given.

It must be apparent that in this paper it would be entirely improper to attempt to go into detail as to the precise things which should be taught in each of these subjects. The only question is, do these subjects, taken together, contain a body of knowledge of high utility to the country boy and girl, and

which may be taught to them? I have already indicated my belief that these subjects do embrace such a body of knowledge, and that under proper conditions that knowledge may be taught.

THIRD: "WILL THIS BODY OF KNOWLEDGE IF TAUGHT, AND THE TRAINING COMING WITH THE MASTERY OF IT, BE OF GREATER PRATICAL VALUE TO THESE PUPILS THAN ANY OTHER BODY OF KNOWLEDGE, AND ACCOMPANYING TRAINING WHICH COULD BE GIVEN DURING THE SAME TIME?"

This question is one which seems to me needs but little discussion. It is a body of knowledge which directly concerns these people in their subsequent vocations. It is a kind of knowledge which is essential today for success in those vocations. It is a kind of knowledge, both in scope and character, which will rarely be obtained by the individual unless obtained in the school. Is there any other body of knowledge which could be substituted for it, and which would be of higher utility to these people for all the practical purposes of life? If there be such another body of knowledge, I do not know what it is. I am thoroughly convinced that it is not the body of knowledge that these young people now get, even the few of them who complete the work of the secondary schools. Will the effort put forth in acquiring this knowledge result in training as valuable as the training resulting from the acquisition of a body of knowledge of less practical value? I am one of those people who believe that knowledge may be valuable in itself and that its acquisition may furnish the highest kind of training; that the student who spends time anywhere in any grade of school in acquiring knowledge of value only for training, when he might acquire other knowledge valuable for other purposes, and equally valuable for training, is wasting his time and energy. A five-dollar gold piece has a certain definite value, but the individual who would accept a five-dollar gold piece when he had his option either to take that or a ten-dollar gold piece, would be a fool. The essence of training is doing. In nearly

every one of the lines of work suggested, the student is brought into direct contact with things, is trained to study them and their relations to each other, to himself, and to other things; he would furthermore be constantly employed in dealing with these things, and not with words. He would be required to see something, and to do something at every stage of his work, and the seeing and doing would be guided by thoughtful consideration of means and ends. This training, while it would be general in its scope would, at the same time, be specific in nature as well; as it would develop skill along the lines where skill would be needed in his subsequent work. Do not these conditions furnish the best possible elements, both for the training of the mental and physical activities of the individual?

One of the chief purposes in education should be to develop interests, and one of the very necessary outcomes of such a course of training would be to develop an intelligent interest in the activities incident to rural life.

WORK ABOVE OUTLINED CAN NOT NOW BE DONE IN EXISTING RURAL SCHOOLS.

If now I have established the proposition that the line of work indicated is demanded by existing conditions, that it is valuable and feasible, both for knowledge and training, the only question that remains to be answerd is,—Under what conditions can such instruction be given? I wish to say at the outset, that I do not believe it feasible under existing conditions as to age of pupils, preparation of teachers, supervision of school work, and length of the school year, in rural schools as at present organized, to undertake much if any of this work.

A parliamentary commission appointed to investigate and report on Manual and Practical Instruction in Primary Schools under the board of National Education in Ireland, after a most exhaustive examination of the subject, reported last year as follows: "The evidence we have received throughout Ireland, goes to show that the subject as taught is of little educational value. This subject is taught in the national schools as a rule entirely

from a single text book, and is unaccompanied by any practical illustrations, a knowledge of the text book alone being required by the rules of the commission. The children do not get any real grasp of the subject, as no efforts need be made to give them a practical acquaintance with the objects and processes described in the lessons. For example, Dr. T. J. Alexander, Head Inspector of National Schools in Cork, states that the present book teaching is worthless. Mr. Purser, another Head Inspector, expressed the same opinion. Lord Monteagle, who is much interested in agricultural education, is of opinion that the present teaching out of a book is wholly useless if not worse. Similar evidence was given by many other competent witnesses. This opinion is quite in accordance with the evidence we received in England. Mr. T. G. Rooper, one of Her Majesty's Inspectors of Schools in England, declared that he would never encourage the teaching of agriculture merely from a book. We are consequently of the opinion that the course of agriculture as at present prescribed for National Schools, should be altered. The new course should consist of instruction in the elements of the natural physical sciences that have a direct bearing on agriculture, and this instruction should be given with the aid of experments of a simple character, performed as far as possible by the pupils themselves. Such a course of instruction will be of a nature entirely within the capacity of the children of a primary school. It will afford a good disciplinary training for all children, even for those who are not to be subsequently engaged in the practice of agriculture, while it will enable those who are to be so engaged, at a later stage, to make intelligent use of scientific treatises on the subject."

"The course in agriculture thus modified will naturally constitute the course in elementary science for boys in rural schools."

The following is from a publication recently issued by the French government, on "The Teaching of Elementary Ideas of Agriculture in Rural Schools":

"Instruction in the elementary principles of agriculture, such as can be properly included in the program of primary schools, ought to be addressed less to the memory than to the intelligence of the children. It should be based on observation of the every day facts of rural life, and on a system of simple experiments, appropriate to the resources of the school, and calculated to bring out clearly the fundamental scientific principles underlying the most important agricultural operations. Above all, the pupils

of a rural school should be taught the reasons for these operations, and the explanation of the phenomena which accompany them, but not the details of methods of execution, still less a resume of maxims, definitions or agricultural precepts. To know the essential conditions of the growth of cultivated plants, to understand the reasons for the work of ordinary cultivation, and for the rules of health for man and domestic animals—such are matters which should first be taught to every one who is to live by tilling the soil; and this can be done only by the experimental method.

"The master whose teaching of agriculture consists only in making the pupils study and repeat an agricultural manual, is on the wrong path, however well designed the manual may be. It is necessary to rely on very simple experiments and especially on observation.

"As a matter of fact, it is only by putting before the children's eyes the phenomena to be observed, that they can be taught to observe and that the principles which underlie the science of modern agriculture, can be instilled into their minds. It should be remembered that this can be done for the rural agriculturist only at school, where it will never be necessary to teach him the details which his father knows better than the teacher, and which he will be certain to learn from his own practical experience.

"The work of the elementary school should be confined to preparing the child for an intelligent apprenticeship to the trade by which he is to live, to giving him a taste for his future occupation; with this in view, the teacher should never forget that the best way to make a workman like his work is to make him understand it."

The course outlined by the French government indicates that the work designed for the elementary schools is of a character known in this country as nature study, and elementary science lessons, the scope and character of the science lessons being determined with reference to their bearing upon the subject of agriculture.

Nearly thirty years ago the experiment of introducing this subject into the district schools was tried in Canada, and proved so complete a failure that it practically put a stop to the whole matter until within the past two or three years. It is now being undertaken again, and time alone can determine what the success

of the experiment will be. If it should succeed there, it would be no proof that it would succeed here. No teacher is allowed in the schools of the Province of Ontario who has not had at least one year of professional training, and the training schools give instruction in this subject. Whenever we have in our rural schools a body of professionally trained teachers who have had specific instruction in this subject and modes of teaching it, we may then hope to make some progress in the rural schools, but until then, we must look elsewhere for this instruction.

A NEW CLASS OF SCHOOLS NEEDED IN RURAL COMMUNITIES, TO BE KNOWN AS COUNTY SCHOOLS FOR INSTRUCTION IN AGRICULTURE AND DOMESTIC ECONOMY.

Last winter the legislature in Wisconsin enacted a law authorizing county boards to make appropriations for the establishment and maintenance of county training schools for district school teachers, and provided for state aid to the amount of $1,250 to each of the two schools first organized. The state aid was limited to two schools for the purpose of giving opportunity to try the experiment thoroughly before embarking upon it on any extended scale. The two schools were organized this year, and are meeting the most sanguine expectations of their promoters. Indications are that if the legislature shall extend the aid to other schools, there will in the near future be a considerable extension of this line of work.

For the purpose of giving the kinds of instruction I have been discussing, I venture to suggest the following plan:

Extend the idea upon which the county training schools for teachers were organized so as to provide for the establishment of county schools for instruction in agriculture and domestic science. Give to any county establishing such a school, state aid to the amount of at least one-half the sum actually expended for purposes of instruction in such school. Admit to these schools boys and girls who have at least completed the course of instruction in the elementary schools, and who have reached the

age of sixteen. Provide for courses such as I have already considered in discussing the body of knowledge which should be taught, including manual training, and make the course two years in length. Add to the courses already indicated such instruction in language, literature, history, and mathematics as may be carried on in connection with the other work. Such a school should have in connection with it a small tract of land to be used for illustrative and experimental purposes; not the line of experiments which the agricultural experiment station undertakes, but a more simple line which could be carried on under the direction of the teachers, and which would be of value for observation and training purposes. Such a school could give in addition to the other work, a great body of the work now given in the short courses in agriculture offered in our agricultural colleges, and it could carry on work in some lines, considerably in advance of what is now undertaken in those short courses. Such a school centrally located in a county would furnish an opportunity for attendance by residents of the county, at a very moderate expense. Many of the pupils could board at their own homes, while others could board themselves, returning home on Friday night, to remain over Sunday. Such a school would necessarily have to be equipped with such simple laboratory apparatus as would be necessary for the experimental work in science. It would need a well selected library of books on agriculture and domestic economy, and should be supplied with the best periodical literature pertaining to those subjects. It could be made a distributing center for that county, of the agricultural bulletins sent out from the agricultural colleges, and if effort were made to interest the pupils in such of these bulletins as came within the range of their comprehnsion, they in turn would interest their parents in them. The result would be that where one is now read in such a community, ten would then be read, and with greater interest and more intelligence. Such a school would also be a center for meetings of farmers for discussion upon agricultural subjects. When a number of such schools were established, professors could be sent out from the agricul-

tural college, going from one to another, remaining a sufficient time at each to give instruction not only to the students, but to farmers who might care to attend, in various subjects which could not be taken up in the school itself. The dairy industry, for instance, would furnish an excellent field for such work. The example of Denmark furnishes an excellent illustration of the value of such traveling professors. The same plan is successfully followed in Germany, and in Ireland, as well as in some other countries.

RELATION OF THE COUNTY SCHOOL OF AGRICULTURE AND DOMESTIC ECONOMY TO THE COUNTY TRAINING SCHOOL FOR TEACHERS.

If such a school could be established in connection with the county training school for teachers, provision could be made for giving instruction to teachers in such phases of the work in agriculture and domestic economy as could profitably be undertaken in the district schools. With such a body of teachers so trained, we might then reasonably expect to secure some of the results which many hope to see coming from the introduction of this subject into the district schools.

Two difficulties present themselves in the carrying out of this plan. One is the absence of specially trained teachers for this work. The other is the absence of text books in which have been formulated the body of knowledge which should be taught. Our agricultural colleges can very readily supply the teaching force as soon as it becomes evident that there will be a demand for such teachers. In the schools first organized the teachers will have to depend upon themselves and upon the books now published through many volumes of which the material to be taught is scattered. Experience will indicate what work can most profitably be done, and with the development of the system, well considered and carefully arranged text books will follow as a matter of course. I believe such a plan as this is a feasible one, that it will command the support of the people most interested, the

farmers. That it will show tangible results early, and that as the system is extended it will awaken the intelligence of the community where the schools may be, and arouse an interest in matters pertaining to farm life which will give us better trained, more successful farmers, as well as better trained men and women, and better citizens.

TRANSPORTATION OF RURAL SCHOOL PUPILS AT PUBLIC EXPENSE.

By PROF. A. A. UPHAM, STATE NORMAL SCHOOL, WHITEWATER, WIS.

Read before the State Teacher's Association.

The decline of the rural school and the consequent need of consolidation have been so recently presented on this platform that time need not be spent in rehearsing the facts. It is well known that not only in Wisconsin but also in other states the migration of population has been towards the cities, so that while at the beginning of the century 96% of the population lived in the country, at the end less than 70% were left.

In the last 35 years the rural population of New York has decreased one-third. Of the 11,000 school districts nearly three thousand, or more than one-fourth, have six pupils or less, and two-thirds have less than 21. Vermont has 153 schools with less than 7 pupils each. Maine has 1,000 with less than 13 pupils each. Wisconsin has 183 with less than 6; 858 others with less than 11; with a total of 3,222 with less than 21 each.

The new conditions demand new adjustments. The adjustment suggested is transportation of rural school pupils at public expense.

It has seemed that it would be most profitable to ascertain what other states are doing and the results of their experiments. To this end, I have solicited information from the State Superintendents of all the states and territories, from many of the County Superintendents and township trustees, from patrons whose children were transported, from the drivers of the teams, from the Principals of the central schools, and from the transported children.

From the reports received it appears that eighteen states have a law allowing the transportation of pupils at public expense, and thirteen are availing themselves of the privilege. The following is list:

Connecticut,	Massachusetts,	Ohio,
Florida,	Nebraska,	Pennsylvania,
Indiana,	New Hampshire,	Rhode Island,
Iowa,	New Jersey,	South Dakota,
Kansas,	New York,	Vermont,
Maine,	North Dakota,	Wisconsin.

These states have nearly half the population of the United States. Taking the states in alphabetical order, Connecticut is the first state which has a law on the subject.

The law authorizes the school visitors to close small schools and unite them with the schools of adjoining districts. The Connecticut report for 1899 gives the number of schools closed as 84. Number of children transported849. Approxicate cost $12,000. The children are mostly conveyed the whole distance. Sometimes they gather at the old schoolhouse, or at some convenient point from which the team starts. In some cases all who live more than a mile away, or some other fixed distance, are carried without regard to distance. Sometimes the town owns the vehicle and hires the driver. In one town a sum per day, depending on attendance, was paid to parents. In one town $20.00 per term, for each family or bunch of children, was allowed and deduction made for absence. It was noticed that the attendance was good in such cases. The expense is less than the cost of maintaining schools. One town expending $292.00 effects a saving of $300.00 yearly. The vehicles are covered and made comfortable by blankets and rugs. In all cases emphasis is laid upon the fact that the driver should be selected with much care.

In Connecticut the amount expended runs from $10.00 per year in the town of Bozrah to $1,380 in Windham. Ashford pays a family or bunch of children living two or more miles from

school $20.00 per full term. They pay the same whether the children are carried or not. Under those conditions the children become quite robust and able to walk.

In only one case in Connecticut was the cost increased. The report says: "Transportation is a success."

FLORIDA.

Florida reports two counties instituting the plan of transporting children. From one of these, Citrus, I learn that they are transporting three small schools four to six miles, 20 pupils at $1.50 per pupil per month. The plan is growing in popular favor and they expect to do more next year. A copy of the notice to bidders specifies a vehicle of sufficient capacity, necessary umbrellas, wraps, etc., to keep the children comfortable, a good and reliable horse, and driver who is trustworthy and who shall have control of all the children—said driver to the B. of P. I., to deliver pupils between 8 and 8:40 and return them, leaving at 4:05, and to give a $100 bond for the faithful performance of his work. The teacher of the central school is required to make out a monthly report registering the arrival and departure for each day, dates and causes of failure, and if there is any complaint, report it promptly by letter.

Duval Co., Florida, is transporting 176 pupils at $303 per month, having closed 14 schools. They began with two schools two years ago and the plan has been very popular. Extra teachers hired cost $145, making a total cost of $448, for what had before cost $490 per month, thus saving $42 per month. Schools of three teachers and 8-year grades were formed. They are planning now to reduce 45 schools to 15. The Superintendent says, "We furnish wagonettes carrying 8, 12, and 16 passengers, so there is no difficulty in getting farmers to furnish teams and harness; this is an improvement over other ways."

INDIANA.

The next state on the list which seems to be doing something is Indiana. From the State Superintendent I received the names

of six township trustees who are transporting children. The work is not yet general enough to have statistical information gathered. From them I received the following information and opinions:—

One trustee from Richmond reports 100 children transported from two to four miles at a cost of $527.25, or $5.25 per pupil. This man reports that there was at first opposition to the plan, but that now there is very little.

From Henry Co., Indiana, the "Trustee" of New Lisbon reports: "We insist on the very best hack service that can be had, good wagons with springs, weather-proof top, door at rear and window to admit light, cushioned seats and back; carpet on the floor and four heavy lap robes. Heaters could be used but we have never had occasion to use them. Good teams are essential. All our roads are graveled, and the hacks run on schedule time as closely as a railway train. I make it a point to employ the very best men I can find to drive and care for the children." This man transports about 40 children from two to four miles with two hack lines at $3.00 a day for both. He reports that there was some opposition at first but almost none now. By this plan two schools costing together $6.00 per day are dispensed with, so the saving is $3.00 a day. Four-fifths a cent a mile is the average cost of transportation.

To the patrons of this school I sent the following questions:

1st. Is your property injured by the closing of the school and transporting of the children? Most of the answers are in the negative, but two say the property is injured, though one of these says, "The system of central schools is all O. K. if properly conducted. This is the 8th year for central schools and it has been a success."

2nd. Do the children suffer in health? The answers are invariably, "No."

3rd. Is the close association of children in the carriages worse than when they were scattered along the road? The answers again are mostly, "No." One, a woman, answers that she does not think the close association so bad as along the road, if a

proper person is chosen as a driver. One patron says, "The control of the children has caused us more trouble than anything else," and he suggests that the drivers should make the children behave, and that the first one in should pass to the further end of the carriage, and thus avoid stepping on toes. Perhaps, by the time the plan has been running as long as street cars, this will be done. Reports say some drivers get along very well, others do not. The same may be said of teachers. One thinks they are much better off with some one to look after them.

4th. Does the eating of cold dinners affect the question much? Answer, "No, they ate cold dinners before the schools were consolidated."

5th. Is the all-day absence from home objectionable? Answer, "This is just the same as before."

6th. What else have you to say for or against the plan? Answers to this will be given in the summary.

Other places in Indiana report as follows: Crawfordsville, transporting 10 pupils, saves $184 annually. In another place two of seven schools have been closed. In another place 20 children are transported for $1.45 per day. Another reports the cost of transporting 10 children two miles, $96 for a term of six months, one-half cent a mile for the distance actually conveyed. One driver reports that he makes a 15-mile trip daily and finds no difficulty in managing the children.

IOWA.

The school law of Iowa authorizes the contracting with other townships or independent districts for the instruction of children who are at an unreasonable distance from their own school; and where there will be a saving of expense, or increased advantage to the children, the board may arrange for transportation of any child to and from school.

In Winnebago Co. the plan is conducted on the largest scale of any Iowa place.

Number of children conveyed, 49.

Distance two and one-half to five and one-half miles.

Number of teams used, 4.

Cost of team and driver, $25.00 per month.

Number of schools closed, 4; six next year.

Plan has been in operation three years.

Estimated saving, $486.00 per year.

Two-thirds cent a mile.

Forest City transports 15 pupils at $1.50 each per month, an average distance of 4 miles—cost three-tenths cent per mile.

Baldwin, Iowa, transports twelve pupils one and one-half miles at an estimated saving of $11 per month. "Pupils meet at the old schoolhouse, and are left at the old schoolhouse at night. If pupil is not on time he is left. Only one has been left and he has not missed twice. Result is, pupils are never tardy and attendance is very regular. There is plenty of room for pupils in town so there is no extra expense except transportation." As far as the State Superintendent knows, citizens, teachers and pupils are pleased.

There are in Iowa 233 districts or sub-districts maintaining schools with an average attendance of less than 6, and 2,500 with less than 11. Fifty-three per cent. of the independent and 78% of the subdistricts have 20 or less. Three-fifths of the pupils are in ungraded schools.

KANSAS.

The last Legislature of Kansas passed a law providing that where pupils reside three or more miles from the schoolhouse, district boards shall pay to the parent or guardian of such children a sum not to exceed 15 cts. per day, for a period of not more than 100 days, for conveying such pupils to and from school. A fresh inquiry within two weeks failed to elicit information that advantage is being taken of this law.

State Superintendent J. V. Calhoun of Louisiana says: "We are advanced only so far as talking about consolidation of rural schools and transportation of pupils. We are doing something but we need to convince and then find funds."

MAINE.

In Maine the committee may transport or pay the board of pupils at a suitable place near any established school. Maine has 1,000 schools averaging less than 13 pupils each. "The fact that school districts have been abolished or that the school committee has suspended schools does not necessarily entitle public school children to conveyance."

MASSACHUSETTS.

The condition of the rural schools and the matter of transportation in Massachusetts is the subject of a special report by G. T. Fletcher, agent of the Massachusetts Board of Education. From this we learn that Massachusetts enacted a law in 1869 providing for the conveyance of pupils to and from public schools. The first town to take advantage of this was Quincy—closing two schools in 1874.

In 1889 Agent G. A. Walton found that the cost of educating pupils in some *small* schools was $50 each, while in schools of 25 pupils, the cost was $10.00 each.

The growth of conveyance in Massachusetts is shown by the increased expenditure, $22,000 in 188–99; $30,000 in 1890–91; $50,000 in 1892–93; $91,000 in 1895–96; $123,000 in 1897–98, and $124,409 in 1898–99.

To ascertain the state of feeling in Massachusetts, Agent Fletcher in preparirg his report sent circulars of inquiry to each city and town in the state. About 200 replies were received, representing about all the different conditions. From this report I select a few points. More than 50% of the towns report changes in population affecting school conditions.

One town reports cost of schooling in small school $46.82 per year, $16.30 in central building. One district formerly had 60 to 80 pupils, now 13. Many towns have gained in the villages as much as they have lost in the country. "Within ten years 229 towns have practically abandoned the old fashioned district school and in its place have established central graded schools

One Superintendent reports favorable results after 18 years of trial. Less sickness among transported children, and a saving of $600 annually. Sixty per cent. of the towns raise money by specific appropriation, separate from the regular school fund; 40 per cent. make the regular school tax cover the cost of conveyance. "Fifty per cent. convey the whole distance, in the other towns the children walk to some designated point, except in some cases the carriage goes to each home in stormy weather. In some cases conveyance is furnished only in winter or stormy weather. Sometimes the children are conveyed *to* school but not *from* it except in stormy weather."

As to what is to be construed as a reasonable distance there is much difference of opinion. Age, strength, sex, nature of the road, amount of money, and disposition of the committee seem to be determining factors.

The weight of opinion in the Massachusetts report is decidedly in favor of consolidation and transportation. Frank A. Hill, Secretary of the Mass. Board of Education, in a letter dated Nov. 15th says: "The increase from $22,000 ten years ago to $127,000 at the present time measures, I think, in a trustworthy way the growth of the policy of consolidating public schools in our rural towns and transporting children to stronger central schools."

NEBRASKA.

Nebraska has a law and is working under it in several places, notably, Fremont and Lincoln. One district reports a saving of $70 a month.

In addition to the law providing for transportation, Nebraska provides that a district may contract with a neighboring district for instruction of pupils and may transport its pupils to such district without forfeiting its right to share in the state apportionment of school fund. The State Superintendent says: "Best of all is, the pupils are better taught."

NEW YORK.

New York has a law and last year annulled 82 districts. Two hundred contracts have been filed during the present year, and State Supt. Skinner thinks 300 will be, before the year is over. Pupils conveyed are not enumerated separately, so there are no statistics showing number of pupils conveyed. Contracts were first made in 1896. Twenty-seven in all. The increase to over 200 this year shows the system to be very popular wherever tried.

NORTH DAKOTA.

North Dakota has a law, first in operation last July, that pupils two and one-half miles away may be transported.

OHIO.

One of the most noted examples is found in Kingsville, Ohio, a report of which was published in the *Arena* for July, 1889. The Kingsville experiment was made possible by a special act of the legislature passed for the benefit of this one town. This bill enacted that any township which by the census of 1890 had a population of not less than 1,710, nor more than 1,715, might appropriate funds for the conveyance of pupils in subdistricts. The law was based specifically upon the rate of population of Kingsville and was so worded to gain the support of legislators from other sections of the state, who were attached to the old plan, but who would not object to the object lesson. The residents of Kingsville have realized all their fondest hopes. The average attendance has much increased and better schools have been provided. Fifty pupils have been conveyed, and the annual cost of tuition has been reduced from $22.75 to $12.25 per pupil. The plan enabled the Kingsville school to open a new room and supply another teacher to the central school, thus reducing the number of grades in a room. The daily attendance has increased from 50 to 90 per cent., thus increasing the return from the school fund invested. Over a thousand dollars was saved in Kingsville in three years.

The law has since been made general in Ohio and is everywhere proving satisfactory. Other townships in Ohio have followed the lead of Kingsville. One county, Madison, reports a decrease of tuition from $16.00 per year to $10.48 on basis of total enrollment, and from $26.06 to $16.07 on the basis of average attendance. But the item of cost is not the most important. The larger attendance, more regular attendance, better schoolhouses, better teachers, and the greater interest and enthusiasm that numbers bring are most important.

In another Ohio place, circles are drawn around the schoolhouse one mile and two miles distant. Pupils inside the first circle get themselves to school. Pupils between the two circles receive $1.00 per month, and pupils outside the two-mile circle receive $3.00 per month, and furnish their own transportation.

PENNSYLVANIA.

Pennsylvania has a law providing that transportation may be done at a cost not exceeding the cost before closing the school.

RHODE ISLAND.

Rhode Island has a law, and is transporting. Emphasis is here laid upon the increased attendance; two schools having graduated ten pupils together in two years, and after consolidation, 16 pupils in one year, an increase of over 300 per cent. in the number of those who remained through the upper grades.

SOUTH DAKOTA.

South Dakota has a law, and many are about convinced that where pupils live three or four miles they could have better schools at less cost. I was informed that transportation has been begun but have been unable to learn particulars or localities.

VERMONT.

In Vermont, on a written application from ten resident taxpayers of the town a portion of the school money not exceeding 25% may be used to transport scholars, where residence is one and